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ABSTRACT

Three measurements for describing different aspects of sociometric status in a longitudinal study are presented. The measurements were developed over the course of an investigation into stability and change in social positions within a school class. The subjects were Swedish schoolchildren aged 10-13 years. Information about the pupils' sociometric status was obtained from their choices in six preference situations: choice of working partner and playmate (grade 3); choice of classmate (grade 4); choice of working partner and playmate (grade 5); and choice of classmate (grade 6). The positions of the children in the social hierarchy were determined by three measurements: (1) the "mean" indicating the individual child's position in the existing hierarchy; (2) "developmental trends" determining stability in the individual's status development; and (3) "variation" indicating the degree of uniformity and variation in the individual pupil's development trend. These three measurements were found to be most useful for describing the sociometric status of an individual schoolchild. (MM)

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MEASUREMENT OF STABILITY AND CHANGE  
IN SOCIOMETRIC CHOICE STATUS

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## SUMMARY

This investigation presents some measurements of stability and change in the sociometric choice status for a group of schoolchildren aged 10-13 years. Information about the pupils' sociometric status is obtained from their choices in six preference situations:

Choice of working partner and playmate (grade 3)

Choice of classmate (grade 4)

Choice of working partner and playmate (grade 5)

Choice of classmate (grade 6)

The position of the children in social hierarchy of their peer-group, has been determined by calculating the average level of each pupil's sociometric status.

This is indicated by  $M_z$ .

Developmental trends in sociometric choice status have been obtained by determining the slope of a regression line based on six observations for each pupil.

A measure of variation within developmental trends is based on the deviations of the observed values from the regression line ( $\sqrt{\sum d^2/n}$ ).

These measures of stability and change are independent measurements reflecting different aspects of sociometric status.

1. Introduction.

Sociometric methods are employed to study the social relationships between members of a group. One of the most frequently used methods is the administration of questionnaires to group members in order to obtain information about their preferences for the other members of the group. This makes it possible to get a picture of each individual's sociometric standing in the group.

Since the publication of MORENO's book "Who Shall Survive" (1934) numerous studies of sociometric status have been conducted. A person's sociometric status is largely dependent on his or her individual qualities. GRONLUND (1959) establishes the existence of a "general social acceptability factor operating in the choice process" (p. 152).

The majority of research workers have found sociometric status to be a reasonably stable and psychologically relevant measurement. NORTHWAY (1967) emphasizes the remarkable constancy of a person's sociometric status and comes to the conclusion that sociometric tests

"... are measuring something more than they purport to do. They may be designed only to measure the preferences present in a group at one time but they seem to be locating some underlying factor that is expressed in the different choices." (NORTHWAY, 1967, p. 25)

However it is possible for a person's sociometric status to vary from one measurement occasion to the next. In some cases, these variations will be of considerable size (see e.g. JOHANNESSON, 1954, p. 160). If these variations are merely of a temporary nature, the average level of a person's sociometric status over several occasions is a more reliable and, consequently, a more useful measure of social attractiveness than sociometric status on one occasion.

In longitudinal studies, where repeated measurements of sociometric status are made, the correlation coefficient is usually used as a measure of stability.

It is possible that noticeable fluctuations in sociometric status reflect crucial changes in the development of the individual. It is therefore worth obtaining a measure of change in a person's sociometric status in order to be able to relate status development to other variables.

## 2. Aim

The purpose of this investigation is to develop and describe measures of stability and change in social positions within a school-class and at the same time to investigate how these measures co-vary.

## 3. Sampling

The project "The Development of Children in a Swedish Urban Community" has been described in previous reports (KARLBERG et al., 1968). It is a longitudinal study of children born in Solna during the years 1955-1958.

In 1958, the investigated group consisted, in its entirety, of 212 children. Data from school-age is available for 208 of these 212 children.

The representativeness of this group is discussed in detail in the above report. With respect to socio-economic background the group may be said to represent not only Solna, but the entire Greater Stockholm area. Even other variables such as mother's age, number of children born out of wedlock, length of pregnancy, child's birth order and birth-weight reflect conditions in Greater Stockholm.

## 4. Methods

### 4.1. Collection of data

In the majority of sociometric investigations, data has been collected by means of questionnaires. Different techniques can be distinguished: positive choices, negative choices, paired comparisons, rating of all group members and the so-called "Guess-who"-technique (GRONLUND, 1959; BJERSTEDT, 1963).

Only positive choices have been used in the present study. Identical sociometric measuring instruments have been used in grades 3 and 5. The following two questions are included in a questionnaire administered to the pupils:

"Which member of your class do you prefer to work with?

- |               |          |
|---------------|----------|
| Most of all   | 1. ....  |
| Second choice | 2. ....  |
| Third choice  | 3. ...." |

"Which member of your class do you prefer to play with at break?

- |               |          |
|---------------|----------|
| Most of all   | 1. ....  |
| Second choice | 2. ....  |
| Third choice  | 3. ...." |

In grades 4 and 6, the pupils are asked to answer the following question in a questionnaire:

"Imagine that you and some of your classmates had to move to another class in the same grade. If you were allowed to decide which of your classmates were to move with you, who would you choose?

Write the Christian names and surnames of those you would like to move with you to another class on the dotted lines provided.

- |         |           |
|---------|-----------|
| 1. .... | 4. ....   |
| 2. .... | 5. ....   |
| 3. .... | 6. .... " |

For the benefit of this study, where data from all preference situations and occasions are to be included in the calculation of a longitudinal measure, it would have been better if identical measuring instruments had been used in all four grades. It is possible that the differences in a pupil's sociometric status may partly be due to the different aspects placed on the choices.

Furthermore, we have information only about the pupils who are named by their classmates. A more extensive data collection, such as the ranking of all members of the class, would with all certainty have identified pupils who are entirely or partially isolated from the companionship of their classmates. If a negative choice technique had also been employed, pupils actively rejected by their peers could have been identified. It is primarily for ethical reasons that the sociometric choice aspects have been limited in this study.

#### 4.2. Treatment of data

When analysing the data, the childrens' preferences have been weighted so that in grades 3 and 5, the first choice is given 3 points, the second choice 2 points and the third choice 1 point. In grades 4 and 6, a first choice is given 4 points, a second choice 3 points, a third choice 2 points and fourth, fifth and sixth choices 1 point. The weighting of preferences is a relatively common procedure (STERNER, 1953, p. 22). The rationale of this method is that first and second choices express a ranking of peers. That fourth, fifth and sixth choices are all given one point reflects our opinion that it is probably very difficult for the majority of pupils to rank accurately more than three or four of their peers. (Compare JOHANNESSON, 1954, p. 107).

The sociometric data have been analysed separately for boys and girls. Several authors have found that a sex barrier to sociometric choosing exists in mixed classes.

"It has been noted in sociometric choosing among school children that there is a cleavage between the sexes. That is, boys tend to direct the majority of their choices toward boys, and girls confine the majority of their choices to girls." (GRONLUND, 1959, p. 102)

The points received by each pupil have been added up and the totals ranked for each grade. Boys and girls have been ranked separately. The ranks have then been transformed into expected z-values with the aid of tables compiled by FISCHER and YATES (1957). In order to avoid negative values, the constant 3 has been added to all z-values. These values enable a direct comparison of the sociometric status of pupils in different-sized groups.

#### 4.3 Analysis of the drop-out group

The investigated group consists in all of 120 boys and 88 girls. In the present study, 94 boys and 71 girls have taken part in sociometric tests in grades three through six of the compulsory comprehensive school during the years 1965-1971. Thus, sociometric data in one or more grades is missing for 26 boys (20 %) and 17 girls (19 %).

To determine whether or not these drop-outs belong to a specific group as far as sociometric status is concerned, the mean and standard deviation have been calculated for the investigated group on each occasion and for the pupils in the drop-out group on the occasions when information is available.

The results of this analysis show that the investigated group and the drop-out group do not differ with respect to the mean and standard deviation of their sociometric status on each measurement occasion.



5. Measures of stability, developmental trends and variation

5.1. Stability in sociometric choice status

Six values are included in the calculation of sociometric status - two values in grade 3 (work, play), one value in grade 4 (choice of classmate), two values in grade 5 (work, play) and one value in grade 6 (choice of classmate).

Figures 1 and 2 below, give examples of the distribution of sociometric status.

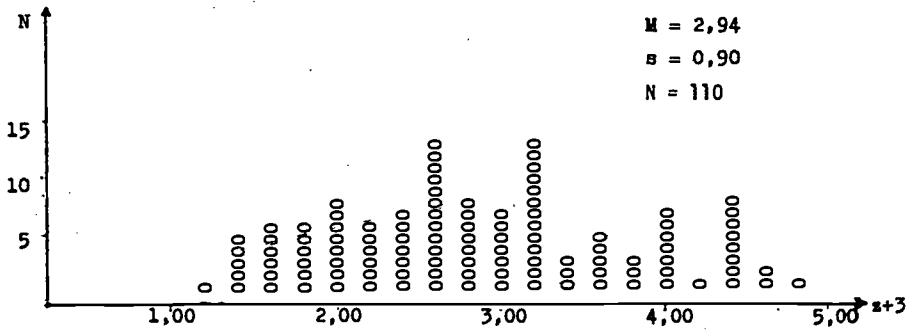


Fig. 1. Sociometric status for boys in grade 3. Choice aspect-work.

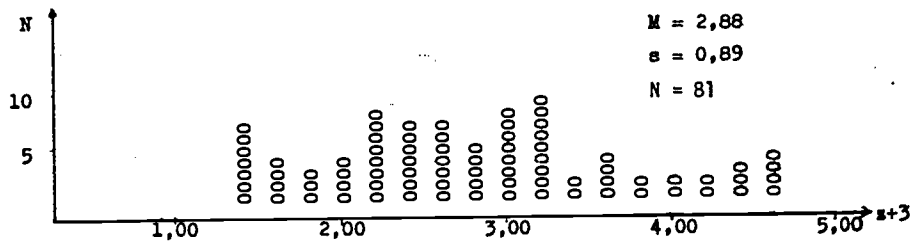


Fig. 2. Sociometric status for girls in grade 3. Choice aspect-work.

To what extent the measures of sociometric status yielded in the three different preference situations are comparable, is a matter of question. Correlations between sociometric status in different preference situations have been calculated for boys and girls respectively and are presented in table 1.

**Table 1.** Correlations between sociometric status in different preference situations.

| BOYS    |           | Grade 3 |      | Grade 4   | Grade 5 |      | Grade 6   |
|---------|-----------|---------|------|-----------|---------|------|-----------|
|         |           | WORK    | PLAY | CLASSMATE | WORK    | PLAY | CLASSMATE |
| Grade 3 | WORK      |         | .72  | .45       | .42     | .29  | .33       |
|         | PLAY      |         |      | .50       | .38     | .30  | .25       |
| Grade 4 | CLASSMATE |         |      |           | .50     | .45  | .54       |
| Grade 5 | WORK      |         |      |           |         | .68  | .56       |
|         | PLAY      |         |      |           |         |      | .49       |
| Grade 6 | CLASSMATE |         |      |           |         |      |           |

| GIRLS   |           | Grade 3 |      | Grade 4   | Grade 5 |      | Grade 6   |
|---------|-----------|---------|------|-----------|---------|------|-----------|
|         |           | WORK    | PLAY | CLASSMATE | WORK    | PLAY | CLASSMATE |
| Grade 3 | WORK      |         | .67  | .51       | .46     | .14  | .48       |
|         | PLAY      |         |      | .55       | .30     | .17  | .51       |
| Grade 4 | CLASSMATE |         |      |           | .52     | .52  | .58       |
| Grade 5 | WORK      |         |      |           |         | .64  | .50       |
|         | PLAY      |         |      |           |         |      | .42       |
| Grade 6 | CLASSMATE |         |      |           |         |      |           |

The correlations between the preference situations "Work" and "Play" in grades 3 and 5 indicate that a popular working partner is often also popular as a playmate. Thus, the same children are often socially attractive in both respects. The rest of the correlations shown in table 1 are of moderate size although consistent in direction.

Even the choice of classmates in grades 4 and 6 may depend on a factor of social attractiveness (GRONLUND, 1955). However, as this preference situation is never presented at the same time as the "Work" and "Play" situations, we have no possibility of calculating a concurrent correlation.

The correlations between measures of sociometric status in different grades is, as expected, lower than the correlation between concurrent measures. Probably individual qualities determining social status vary with age.

Other studies show that, at this age level, fairly similar results are obtained from sociometric tests even when the preference situations are varied. BJERSTEDT (1956) comes to the following conclusion:

"However, it does not seem too much to state that preferential status seems to be relatively general at this age (9-14 years), so that workmate choices, schoolyard companion choices, and friendship reports give similar status rankings, and that thus it is not quite impossible to "translate" from one preference situation to another". (BJERSTEDT, 1956, p. 217).

GRONLUND sums up the situation thus:

"In general, sociometric status on one criterion was closely related to sociometric status on other criteria; sociometric status tended to be consistent in groups of varying membership; and sociometric status remained fairly consistent from one measuring technique to another". (GRONLUND, 1959, p. 152)

With support of the above quotations, we can say that the pupils in this investigation have been presented with three fairly similar preference situations and that the results reflect a general factor of social attractiveness. For this reason, the mean level of the pupils' sociometric status,  $M_z$ , is of interest. The distributions of sociometric total means for boys and girls respectively are presented in figures 3 and 4.

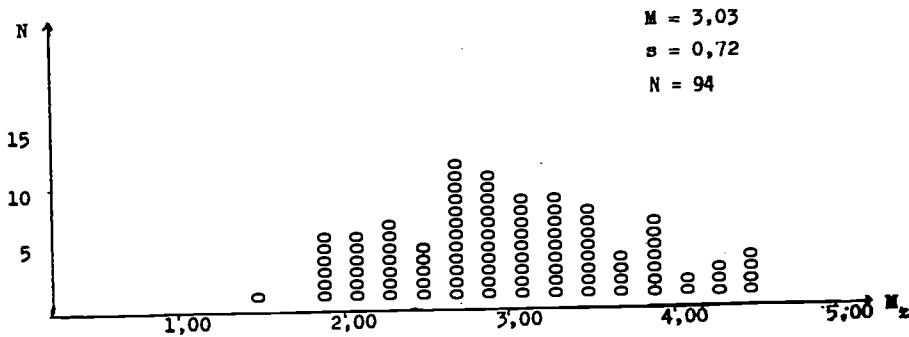


Fig. 3. Total mean sociometric status for boys in grades 3, 4, 5 and 6.

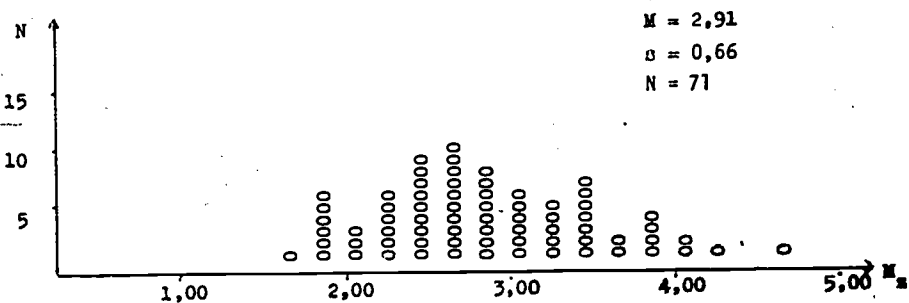


Fig. 4. Total mean sociometric status for girls in grades 3, 4, 5 and 6.

As can be seen from figures 3 and 4, the pupils' mean status in the six preference situations is concentrated around the mean, 3.00. The standard deviation decreases, as the most extreme individual values disappear when calculating the mean.

### 5.2. Developmental trends in sociometric choice status

Developmental changes in a person's sociometric status can be defined in many different ways, one of which involves the use of regression lines. HINDLEY (1962) used regression lines to measure change in individual I.Q. He uses the following arguments to motivate his choice of method:

"... because we had only four data points available for each child, the best fitting straight lines of quotients against age were considered to provide the most convenient summary of different individual trends

.....

The slope of such a line ... indicates whether the child's score is rising or falling, relative to that of the group". (HINDLEY, 1962, p. 30-31).

In using this method to study developmental changes in sociometric status, we have calculated regression lines for each pupil using the data from 6 preference situations ("Work" and "Play" in grades 3 and 5, "Choice of classmate" in grades 4 and 6). As the correlations between the two preference situations "Work" and "Play" in grades 3 and 5 is relatively high, it could perhaps be possible to regard these situations as equivalent. In this way calculations of the regression lines could be based on a single value from each grade. These two ways of data treatment have both disadvantages and advantages. In this investigation we have decided to use data from all the preference situations available.

The calculations yield b-values which describe the slope of the regression lines (MAGNUSSON, 1966, p. 49-55). High positive b-values indicate rising sociometric status, b-values around 0 indicate stable status and negative b-values indicate falling status. Examples of regression lines are given in figures 7 and 8. The distributions of b-values for boys and girls respectively are given in figures 5 and 6.

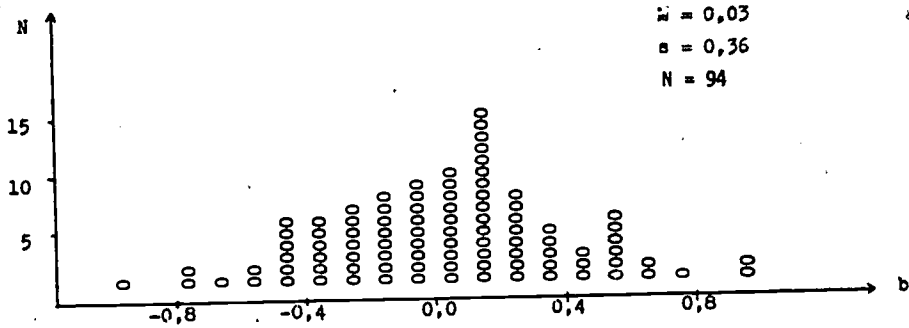


Fig. 5. Distribution of change in sociometric status (slope of regression line). Boys.

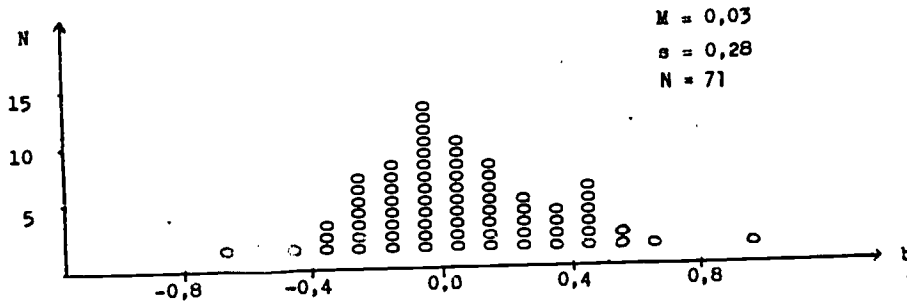


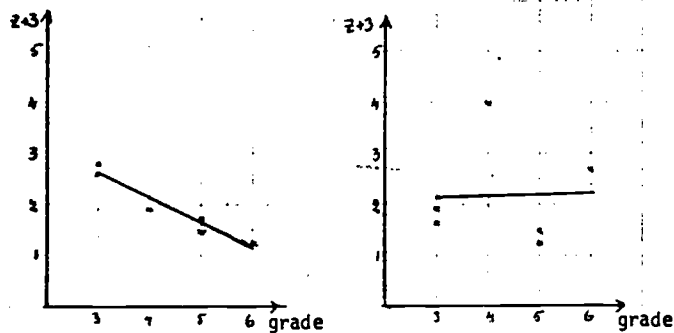
Fig. 6. Distribution of change in sociometric status (slope of regression line). Girls.

The majority of pupils have b-values around 0,0, indicating high stability of sociometric status. However, certain pupils can be seen to have values lying above +0,4 or below -0,4. This means that some pupils are characterized by an essential rising or falling development in their sociometric status from grade 3 to grade 6. As can be seen from figure 7, a b-value of -0,49 indicates a considerable drop in a pupil's status.

### 5.3. Variation in developmental trend

Using regression lines as well as separate values, a graphical description of status development from grade 3 to grade 6 has been constructed for each member of the investigated group.

When these figures are more closely examined, it is obvious that the regression line does not always give an adequate description of status development. This applies to cases where the variation in sociometric status from grade to grade is highly unsystematic - see figure 7.



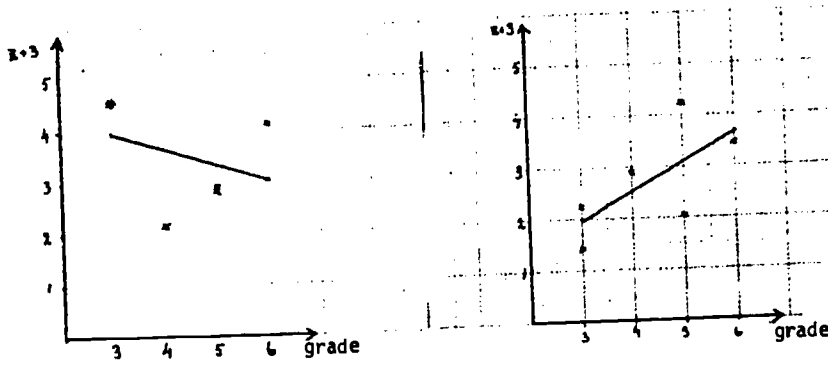
Pupil A.  $b = -.49$

Pupil B.  $b = .02$

**Fig. 7.** Example of two pupils' sociometric development. The development of A is satisfactorily described by the regression line while the development of B is highly unsystematic.

In order to obtain a measure of variation around the regression line, the sum of the squared differences between observed and estimated values of sociometric status in each preference situation has been calculated. Thus, in figure 7, the variation for pupil A is found to be  $\sum d^2 = 0,12$  and for pupil B  $\sum d^2 = 5,16$ .

If the sociometric development for pupils with a great variation in status (a large  $\sum d^2$  value) is examined it is seen that certain pupils exhibit an extremely unsystematic status development (compare fig. 7 above, pupil B), while the development of others is almost curvilinear (see pupil C fig. 8 below). Some pupils with a large unsystematic variation differ considerably in the preference situations "Work" and "Play" in grade 3 and/or grade 5 (see pupil O, fig. 8 below).



Pupil C.  $b = -.30$   
 $\sum d^2 = 4.70$

Pupil D.  $b = +.56$   
 $\sum d^2 = 3.01$

Fig. 8. Example of a pupil with a seemingly curvilinear status development (pupil C) and a pupil varying considerably in status in the preference situations "Work" and "Play" in grades 3 and 5 (pupil D).

Because the distributions of variation in sociometric status ( $\sum d^2$ ) are markedly skewed,  $\sqrt{\sum d^2}$  is used as a measure of unsystematic variation in the calculation of correlations. The distributions of  $\sqrt{\sum d^2}$  for boys and girls respectively is given in figures 9 and 10 below.

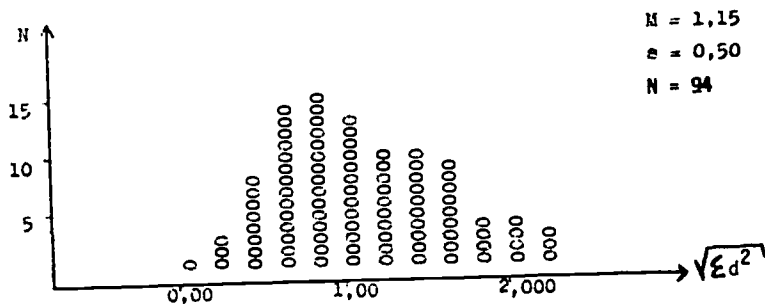


Fig. 9. Variation in sociometric status ( $\sqrt{\sum d^2}$ ). Boys.

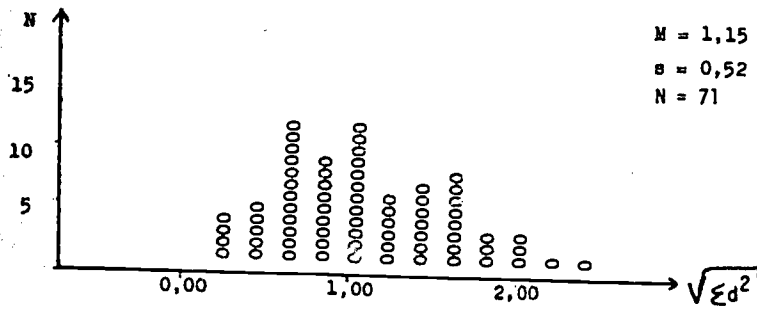


Fig. 10. Variation in sociometric status ( $\sqrt{\sum d^2}$ ). Girls.

5.4. Relationship between the different types of measurements

The suggested and calculated values of stability and change in the sociometric status of the pupils, sociometric mean, change in status and variation in developmental trend, are, statistically speaking, independent variables (compare MOOD & GRAYBILL, 1963, p. 328-359, or HAYS, 1963, p. 474, p. 518). However, we have calculated the correlations between the different measurements as a control procedure. The results are shown in table 2.

Table 2. Correlations between  $M_z$ ,  $b$  and  $\sqrt{\sum d^2}$ .

| BOYS              |       |      |                   |
|-------------------|-------|------|-------------------|
|                   | $M_z$ | $b$  | $\sqrt{\sum d^2}$ |
| $M_z$             | •     | .05  | -.17              |
| $b$               |       | •    | .01               |
| $\sqrt{\sum d^2}$ |       |      | •                 |
| GIRLS             |       |      |                   |
|                   | $M_z$ | $b$  | $\sqrt{\sum d^2}$ |
| $M_z$             | •     | -.07 | -.05              |
| $b$               |       | •    | -.01              |
| $\sqrt{\sum d^2}$ |       |      | •                 |

The results show no linear relationship between the variables and thus confirm theoretical expectations.



## 6. Concluding Remarks

We have here presented three measurements for describing different aspects of sociometric status in a longitudinal study.

The first of these measurements, the mean ( $M_2$ ), indicates the individual child's position in the existing group hierarchy. It tells us whether he is to be found on the highest or lowest level or if his position lies somewhere in the middle of the group. Thus the mean tells us to which social stratum a child belongs.

In a longitudinal study it is important to establish and analyse trends in the individual course of development. Developmental trends, i.e. change and stability in the social position of the pupil, can be arrived at by calculating b-values for the pupil's positions in the various preference situations. A positive b-value indicates a rising developmental trend while a negative b-value indicates a falling trend. Calculating b-values is however not sufficient for determining the stability in the individual status development. It is also necessary to have a measure for variations and uniformity within the developmental trend.

The third measurement is therefore one of variation. It is obtained by calculating the deviation from the b-line of the individual values. This measurement gives us information about the degree of uniformity and variation in the individual pupil's developmental trend.

These measurements seem to be most useful ones for describing the sociometric status of an individual group member.

In future studies we intend to employ these measurements to carry out more intensive studies comparing pupils with high and low sociometric status, pupils with a rising and falling developmental trend and pupils with a high uniformity in development with those with a fluctuating course of development.

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