AN EXPLORATORY SURVEY OF TEACHERS OF MATHEMATICS IN THE STATE UPPER SECONDARY SCHOOLS IN ITALY: SOME RESULTS

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Premise

The Italian State Upper Secondary School (age 14+) is extremely diversified. It covers various principal areas of study and a multiplicity of "streams", within each area. In the school year 1984-85, the breakdown of students was as follows:

The Italian System of Upper Secondary Education

Area	Type	No. of streams	Students No. (=000)	Students %
Academic	Classics	1	207	8.1
	Sciences	1	351	13.8
Vocational	Technical	48	1156	45.4
	Business & Industry	23	504	19.8
	Teacher training	2	211	8.3
	Foreign languages	1	49	1.9
	Art schools	2	69	2.7

Syllabuses in the various kinds of school are extremely varied. Even the teaching of Mathematics is carried out along various different lines. As for Statistics and Probability, these are taught in a number of technical and business institutes and involve about 25% of the student population, though only a small minority study the two subjects at any depth.

Survey of Teachers of Mathematics in the Upper Secondary Schools

The survey concerned a sample of teachers of mathematical subjects in Upper Secondary Schools during the school year 1984-85. The sample was made up by stratifying Italian schools, according to type and geographical area (North, Centre, South plus the Islands). Within the ambit of the schools selected, all teachers in service in the schools during the year referred to were approached through questionnaires sent by mail to their home addresses.

The questionnaire covered 221 variables, articulated into 8 blocks:

- Personal particulars (sex, age, marital status, place of residence)

- Information regarding the school where each teacher is in service

- Information regarding his/her University education, with special reference to the content of statistics and probability

- Information as to professional activity carried out both inside and (if any) outside the school

- Information as to teaching methods(text-books adopted, progress tests, use of pocket calculators, personal computers, etc.)

- Opinions regarding the mathematics syllabuses (the judgement of the present programmes and the advisability of modifying them; notes on the contents of the discipline to be introduced or corroborated, with specific reference to the area of statistics and probability).

The survey was carried out during the period May-December 1985, by sending an (anonymous) questionnaire to the teacher's known address, accompanied by a card in the teacher's name to be returned separately as proof that the questionnaire had been returned. There was a 70% response; if we take into account the fact that 3% of the questionnaires were returned to sender because of wrong or changed addresses, the replies that were not received amounted to 27%. No survey was carried out on those who failed to reply.

The percentage of replies received was approximately the same for all three geographical areas and for the various types of school. The quality of the replies seemed to be good. Very few of the questionnaires were unusable. In point of fact the replies from 1338 teachers were included in the survey.

The main characteristics of the teachers

Of the teachers who replied to the survey, 55.6% were female and 44.4% male. These proportions are in line both with those originally approached and with the overall number of teachers in Italian State Upper Secondary Schools.

In general, teachers of Mathematics graduated in Mathematics (64.6%), Mathematics and Physics (12.5%) or Physics (9.7%). The remaining 13.2% came prevalently from Faculties of Biology, Economics, Social Sciences or Engineering.

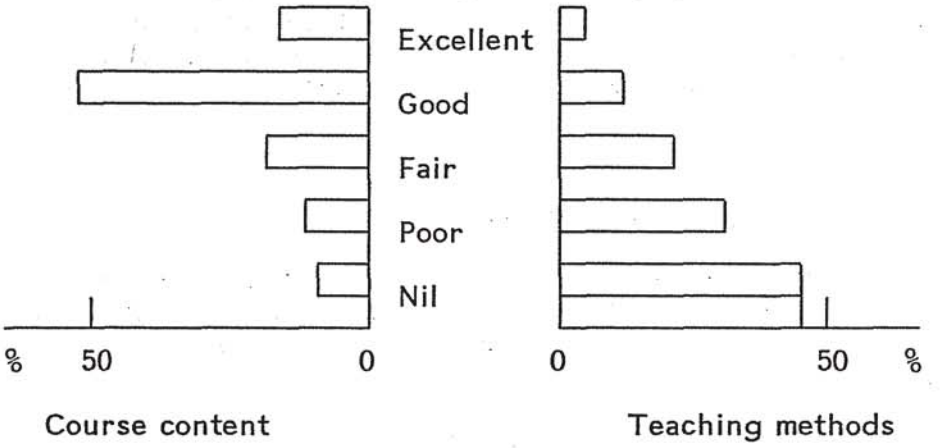
The average age of the teachers polled was 41 years, with a standard error of approx. 9 years. More than 40% were over 40 years of age.

Distribution of teachers according to age

Age (years)	No.	%
Up to 30	151	11.3
31 - 35	272	20.3
36 - 40	364	27.2
41 - 50	330	24.7
over 50	221	16.5
	1338	100.0

A particular characteristic of teachers in Italian schools is that they went into teaching substantially without selection: only 30% entered the profession by way of competitive examinations based on an evaluation of their educational standards. The remaining 70% are established in the schools on account of their having held temporary posts there for a certain period of time. Many of these teachers have in any case legitimized their positions through subsequent competitive exams or special courses. Thirty-three percent of the teachers had followed courses at University oriented towards teaching. With regard to their University experience, all these teachers express widely differing judgements, depending on whether they referred to course content or teaching methods.

Judgement regarding University Education



Out of 1338 teachers, 767 (57%) had attended at least one refresher course. Of these, 13% had attended at least one course on probability and statistics.

In this regard it is necessary to bear in mind the fact that fairly few refresher courses on probability and statistics are on offer. The greater number of courses of informatics offered led to an attendance of 40% of the teachers at these courses.

The teachers' attitude towards and assessment of mathematics teaching

The general aims of mathematics teaching should be the following:

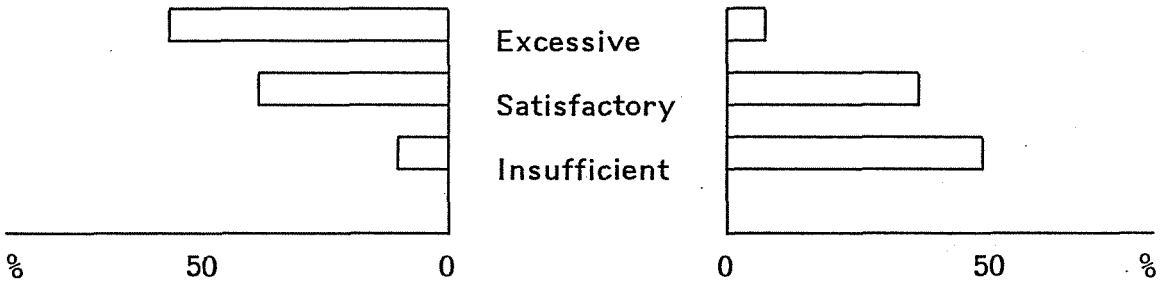
- main emphasis on the tools of the trade 38.6%
- the teaching of key-concepts from a critical view-point 37.2%
- the supply of an exhaustive theoretical framework, even in non-critical forms 21.2%

82.3% of the teachers believe that particular importance should be given to the internal coherence of the subjects dealt with, while only 17.7% consider that topical subjects should be given prominence, even if these are not entirely integrated among themselves.

It may be of interest to note that the "academic" areas stress the educative role of key-concepts and of the theoretical framework (50.3% and 30.2% respectively express the two preferences), while teachers in the "vocational" areas are more concerned to supply students with the tools of the trade (52.9%).

As for the adequacy of the present syllabuses for mathematics, with regard to the time dedicated to the subject and to the educational aims, the results are as follows:

Teachers' judgement of the present syllabuses for mathematics



The teaching of probability and statistics

Particular attention has been given to the teaching of probability and statistics. One specific question concerned the advisability or otherwise of putting these subjects into the syllabuses with at least a brief mention. In the case of statistics those favourable amounted to at least 40% and in the case of probability the proportion rose to 80%. Furthermore, in reply to a more specific question as to the subjects[1] to be inserted, combinatorics

1. There are 20 subjects considered for possible treatment (linear algebra, mathematical analysis, numerical analysis, space geometry, non-Euclidean geometry, analytical geometry, logic, notions of algebraic structures, the history of mathematics, probability, combinatorics, informatics, financial mathematics, linear programming, operational research, statistics, applied mathematics in: the economic and social sciences, physical and natural sciences and technology).

occurs in 2% of the cases, probability 12% and statistics 11%.[2] Only 1-2% of those polled considered these to be the most important subjects.

Teachers who consider subjects from the area of statistics and probability to be necessary (as a percentage of the total interviewed)

	Only brief notes	To a certain depth
combinatorics	48	32
probability	38	45
descriptive statistics	34	17
demography	34	8
economic statistics	27	24
inferential statistics	27	12

Clearly, the type of University education each teacher has had influences his or her attitude towards the insertion of probability and statistics into the course programme.

Attitude of teachers with regard to the inclusion in the syllabuses of subjects related to statistics and probability, according to the type of University degree held (%)

degree (laurea)	would want to include subjects concerning: probability	statistics
mathematics	12.6	10.1
mathematics and physics	16.2	9.0
physics	15.9	15.8
economics	7.7	9.6
statistics	33.3	44.4
other degree	4.0	6.0

The attitude frequently changes with the type of school in which the teacher works, with maximum values (above 20% for probability and 15% for statistics) for those teaching in the top three classes of the Science High School (Liceo Scientifico).

In general teachers approve the idea of introducing new subjects into the syllabuses: 72% argued for the insertion of three new subjects, which was the maximum they were able to indicate; 91% opted for two; and 95% opted for the inserrtion of at least one new subject.

2. Note that these subjects are already present in the syllabuses followed by about 25% of the student population.

Attitude towards the teaching of probability and statistics

The data collected were also classified automatically[3] in order to find typical groups of teachers with regard to:

- education and refresher courses
- attitudes towards teaching
- the school environment in which they work.

The first characterization is particularly clear-cut and the results are given below. The 1338 correspondents were found to divide into the following six groups:

Group 1 (22.9%) – Teachers who in their University courses followed one or more courses dealing specifically with probability and statistics. They are between 35 and 40 years of age and teach in Istituti Tecnici Commerciali (Commercial Technical Institutes) and in Istituti Professionali (Institutes for Business and Industry). The proportion of graduates in Economics is above average. They have attended refresher courses particularly in informatics.

Group 2 (25.7%) – Teachers who in their University courses did not come to grips with subjects in the area of probability and statistics. They were over fifty years of age and taught in academic schools. They had attended few refresher courses and none in the area of probability and statistics.

Group 3 (21.1%) – Teachers who in their University courses did not come to grips with subjects in the area of statistics and probability. Many of them were under thirty years of age and still on temporary contracts within the school system. They have not attended refresher courses and appear to have little intention of going to any.

Group 4 (14.2%) – Teachers with characteristics similar to those in Group 1. They differ generally in that they have not attended refresher courses.

Group 5 (9.5%) – Teachers over 40 years of age, who are extremely reticent in supplying information, both with regard to refresher courses and to their level of knowledge of subjects concerning probability and statistics.

Group 6 (6.6%) – Teachers over the age of 40 who in their University courses never had to deal with subjects regarding statistics and probability. They have attended no refresher courses. They consider that the present mathematics courses should not be reinforced.

The attitude of the six groups towards probability and statistics is given below.

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3. By using the SPAD program (Systéme portable pour l'analyse des données), 1984 version. Copyright by CESIA, Paris.

Attitude of teachers towards probability and statistics

Group	Inertia	Probability	Statistics
1	0.072524	to be studied in depth	to be studied in depth
2	0.065334	general notions only	should be excluded
3	0.047570	should be excluded	should be excluded
4	0.033104	to be studied in depth	to be studied in depth
5	0.030893	not stated	not stated
6	0.017364	should be excluded	should be excluded

Inter-group inertia 0.348580

Total inertia 0.615368

Conclusions

In Italy the knowledge both of the environments in which the teachers work and of their attitudes towards the teaching of mathematics in general and of probability and statistics in particular, is in extremely short supply. The survey of which the broad outlines are presented here aims to fill this gap. The intention is to provide material for policies of reform for the school levels considered.

The outstanding result is in the way it brings out the great differences, not only in basic knowledge and training of teachers, but also in their attitude towards the teaching of mathematics and in particular probability and statistics. This makes it particularly difficult to propose a standard syllabus for the subjects previously mentioned at the Upper Secondary School level. And yet this is the tendency of policy-makers, at least for the first two classes of the Upper Secondary School, which are the first to be reformed. It is quite clear that serious problems that arise at the level of teacher retraining derive from this.

References

Zuliani, A. (1982). The teaching of stochastics in Italian Upper Secondary Schools. In V. Barnett (Ed.), Teaching statistics in schools throughout the world. Voorburg: ISI.

Sanna, F. (1986). Problematiche per l'aggiornamento degli insegnamenti di Scienze Matematiche, Chimiche, Fisiche e Naturali della scuola media italiana. In Pagine in ricordo di Gianni Bellei. Roma: Kappa.

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