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The teaching of informatics to first-year students of Medicine and Nursing, through an interdisciplinary innovative methodology

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Abstract. Teaching informatics to first-year medical and nursing school students cannot be reduced to learning the basics of personal computer use. Students must become familiar as soon as possible with the complete *information system*. Through this interdisciplinary methodology they learned how to collect, structure and record data, to avoid errors and to control quality. Finally, they were able to analyze the data and discuss the results of their investigation.

1. Research objective

A few years ago, in Italy, the teaching of Medical Informatics (MI) was included in the curriculum of Medicine and Nursing University courses. There are very few ongoing experiences all over the country and they differ dramatically for both teaching contents and methodology. Generally, the activated courses thus far are limited to teaching the basics of personal computer use.

Our experience regards first-year courses of both Medicine and Nursing Schools held at the Libero Istituto Universitario Campus Bio-Medico (LIUCBM), a University which began its activity in Rome three years ago. The students, coming from all over Italy, are selected through severe admission tests. The main objective of LIUCBM is to teach modern medicine and nursing at an advanced technical and scientific level, as well as to prepare future health care professionals who will also respect the dignity and freedom of both the healthy and ill individuals.

We agree with other authors[1][2] [3] [4] [5] that the aim of MI teaching is to provide an adequate knowledge of *information systems* as well *computer systems*. According to the US National Library of Medicine MeSH term, an *information system* is an integrated set of files, procedures, and equipment for the storage, manipulation, and retrieval of information, while a *computer system* is a system composed of one or more computers, peripheral equipment, such as disks, printers, and terminals, and telecommunications capabilities. While dealing with information systems, we especially focus on the *procedures*, willing to teach our students the complete cycle of data, from its generation to collection, up to its analysis. They have to be aware of the problems that may arise in any phase of this cycle.

However, this objective does not appear to have widespread resonance in the scientific community. Searching through MEDLINE databases from 1992 to 1995, we have found only 18 articles regarding first-year teaching of informatics to Medicine and

Nursing schools students. Most of the authors report their experience in comparing computer-based learning and seminar teaching applied to specific knowledge of medical subjects (e.g. Mangione[6]); in one case they study attitudes toward computer education [7], or computer-aided problem based learning[8].

Following these guidelines we have developed a teaching system for our first-year courses of Medicine (50 students) and Nursing (25 students). We intended to teach them how to conduct a survey on health conditions of a specific population, through interviews, followed by data entry and processing using statistical methods. The students of all the primary schools in a socially and economically deprived area in the suburbs of Rome were the target population.

The main objective of this research was MI teaching, but another outcome was the knowledge of health and hygienic conditions in the area. The direct contact of our students with children helped them in experimenting the qualities needed by a physician or a nurse while dealing with patients who are not able to precisely communicate their conditions.

2. Presentation of methods

We prepared an original 40-item questionnaire in two parts. The first one included information provided by the primary school teacher about the personal record of the pupil: course, date of birth, weight, height, disabilities, family composition and characteristics. The second one covered the actual interview and concerned health conditions, life habits, hygiene, food and housing situations of the pupils as well as their concept of good health.

The items regarding health conditions were prepared in order to give subjective information (*How do you feel? What does good health mean?*) as well as objective data (days of absence from school, days in bed, hospitalization, physician visits, diagnostic check-ups). Life habits included time spent in study, television, sport, sleep, open-air games, as well as their wishes (*I would like to watch television for .... hours every day*).

Before starting the survey, all LIUCBM students tested the questionnaire on a limited number of boys and girls. They gained experience and collected a list of suggestions and corrections to the original version. The actual questionnaire was therefore the product of the combined work of students and teachers, trying to coordinate all the requirements, including a format suitable for data entry.

A cluster sample was selected among all the pupils of the schools in the area. It was composed by 323 children (161 boys and 162 girls), which represent 12% of the 2655 pupils population.

The interviews were carried out by the students, who later typed the data in a Microsoft Access 2.0 database, using the Runtime module. Each student accessed the database security system with his *logon* name and password which permitted to add records in each session, but not to cancel any previously committed one. The student was allowed only to modify records during the same session, while previously saved record could not be modified. This procedure minimised unwanted accidental alteration of committed records. Most students actually typed all the data in a single session.

The database form contained many checkpoints and validation rules. For example, if you typed a date of birth consistent with an age of more than 15, the message appeared: "It is not likely to be a valid age for a primary school child". Null fields were allowed only in some cases, while other fields could not be omitted (e.g.: sex, course, etc.).

The database was then exported, to allow the students to work on it using Works 3.0 for Windows, a software package they had become familiar with, during the Informatics course. They were able to control quality, by checking for example the coherence of different data (age and course, weight and height and other cross-related answers); they also produced graphics and simple statistics. SPSS for Windows NT, Italian version 6.1.3 was used to finally process the data.

3. Results and discussion

3.1 The teaching methodology

The methodology proved itself to be a valid way of teaching informatics, and it also helped first-year students of Medicine and Nursing in learning basic concepts and applications of statistics, epidemiology [9], community health education and primary prevention. It required a valuable cooperation of future physicians and nurses, preparing themselves to work together in hospitals and health centres.

We have evidence of the effectiveness of the methodology first of all from the great interest of the students. Examining the 50 medical students, we notice that one didn't take part to the interviews, and only another one failed to record the outcome of his interviews, both for actual impossibility. This is a fairly high rate of success in an activity that requires extra hours (going out of the University facilities). Some students offered themselves to help the schools they had been visiting, in carrying on courses about health education. They took part in a final seminar with experts where the discussion of results was lead by three nursing students and two medical ones, with contributions by many more of them. They realized that the work they had been doing shows that similar surveys cannot be analyzed only from a quantitative and measurable point of view, but they need a more comprehensive look. The textual responses (e.g.: *What is dangerous for the health a boy of your age?*) are more difficult to summarize than numbers (e.g.: *How many days of absence from school?*) but they contain a lot more information.

As long as informatics knowledge is concerned, there are also valid indicators. LIUCBM students made a very small number of errors while introducing the data. Over a total of 150 fields for each of the 323 records, we detected less than 100 errors (caused by mis-typing or forgetting to insert the data), that is far less than 1%. This result proved both the efficacy of the database validation rules and the students' ability in using the software.

The students worked on the data using Works for Windows tools. They run any analysis they considered interesting. The medical students' Informatics lab examination (part of the "Statistics and Mathematics" course) was based on the production of graphics and statistics starting from the collected data. Out of the 48 taking part in all the phases, 6 of them scored 10/10, 12 scored 9/10 and 17 scored 8/10. Of the remaining 13, only 3 were below 6/10 (the minimum to pass the exam) but we encouraged also the 10 students who scored 6/10 or 7/10 to repeat the examination. The final results of these 13 students were: 1 scored 10/10, 8 scored 9/10, 4 scored 8/10. It may be interesting to notice that the mean value of the final score in "Statistics and Mathematics" is 27.9/30 while last year it was 27.8/30 and two years ago it was 26.8/30. Necessary is to say that last year a similar methodology was adopted, with the use of computers, even though the interviewed sample was not representative of any population. Two years ago the students were not involved at

all in working with computers besides the normal program of lessons. If we read these numbers together with other examination's scores, we find that they do not seem to depend on the students' scientific background, because in Physics they passed from a mean score of 27.3 two years ago, to a 26.3 this year. We can possibly deduce that there has been a positive influence of the intensive use of this methodology in the last two years.

We have also compared this year scores in "Statistics and Mathematics" of our students with the scores of one course of a State University of Rome, where the students do not follow our methodology. The mean value in LIUCBM is 27.9/30, with a standard deviation of 2.2 for the 49 students, while in the State University it is 25.9/30, with a standard deviation of 2.8 for the 90 students.

3.2 The case study

We may notice that the students demonstrated good skills in data collection. They brilliantly overcame difficulties in interviewing children between 5 and 13 years of age, following the suggestions provided by one of the authors, expert in child psychology. Some of the youngest children had difficulties in correctly expressing time-related concepts (e.g.: number of hours). In these cases, the teachers and the interviewer interpreted their answers to produce the most reliable data.

A picture of the health conditions of the suburban area has also been acquired. A seminar was organized, with the teachers of the schools where interviews were conducted, to discuss with them over the situation and about some ways of improving it. Meanwhile, a deep study is going on, especially on the textual answers, to extract whatever can be useful to help the schools in their health education programs.

Family components could be recorded from 75% of the pupils interviewed. The main reasons for the missing 25% is either scarce knowledge of the teacher (because it was a first-year course or because he/she was standing in for the actual teacher) or fear to hurt the sensitivity of the children or their relatives (even though these ones were not supposed to read the rigorously anonymous questionnaire) in the presence of critical family situations (divorce, illegal adoption, imprisonment, etc.). Our results showed that, differently from other urban areas in Italy and in Rome, the number of family members living in the same home was relatively high: more than 50% of the families included 4 members, while families with 3 or less members were only 18%. Obviously we are aware that *singles* and families with no children were not included in our population sample. Actually in 22% of all valid cases there were no brothers, in 54% one brother/sister was recorded, in 16% 2 brothers, in 9 % more than 2.

The height and weight of the children in this neighbourhood are very similar to Italian mean values. Analyzing the second part of the questionnaire, we can also conclude that nutrition levels are normal.

Health conditions were considered "bad or very bad" by 2,5% of the children (Table 1), while 74% of the cases reported an illness or a health problem during the three months prior to the interview. These conditions did not always provoke absence from school (see details in Table 2), in spite of the fact that a student should consider himself in good health, if he can go to school. We have noticed that these percentages are quite higher than the ones collected by the National Institute of Statistics (ISTAT) on a Italian population sample within the same age limits. Necessary is to say that the ISTAT survey generally gets the answers from the parents and not from the children themselves.

Table 1. Frequency of the answers to the question: "*How do you feel?*"

	frequency	valid percent
very bad	1	0.3
bad	7	2.2
not so bad	43	13.4
well	219	68.4
very well	50	15.6
no answer	*3*	*missing*
Total	323	100

Table 2. "*In the first three months, how many days have you been absent at school for being sick?*"

days	frequency	valid percent
0	127	42.2
1	30	10.0
2	20	6.6
3	29	9.6
4	16	5.3
5	15	5.0
6 or more	64	21.3
no answer	*22*	*missing*
Total	323	100

3.3 Conclusion

We can finally say that the methodology we have been experimenting proved itself to be valuable for the students to better their knowledge and practice of MI and also, generally speaking, as a way for collecting data on the population of children of a particular area of Rome. The cooperation of the authors, each one in his speciality, such as informatics, statistics, psychology, nursing, as well as health care, gave this teaching experience a complete interdisciplinarity.

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