# STAT – DOCTOR
## Interim Report I

## Courseware development team[1]
## Fac. of Psychology, University of Amsterdam

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**Introduction**

STAT-DOCTOR is the first project dealing with large scale introduction of Computer Assisted Instruction at the University of Amsterdam. In this INTERIM-report a description is given of the educational context and the didactic principles underlying the Courseware that has to be developped. Furthermore a description is given of the procedure which has been used to elicit these didactic principles. The appendix gives details about the Courseware implemented at this stage of the project.

**Educational Context**

Statistics is a difficult subject matter for students at our Faculty of Psychology. Rejection ratio's of 40 to 50% were not exceptional until a few years ago additional, more individual, coaching was introduced. This semi-individual coaching took the form of small groups which came together to discuss the subject-matter of the last Course given by the Professor. The coach was another student which was near the end of his/her study. The major cut backs on funding of the Universities in the Netherlands has the net effect of annihilation of this type of teaching. Thus the faculty was faced with the perspective of a drastic reduction of student throughput. The goal was set for large scale the introduction of CAI at the faculty: we had to prevent this student-througput reduction. CAI had to

[1] [1] Volkert Balk, Marcel Veenman, Dick Bierman (coordination). Faculty of Psychology
Weesperplein 8, 1018 XA, Amsterdam, The Netherlands.

replace the working groups. This has been operationalized as follows. Each hour of regular lecture has to have its hour of CAI-counterpart. Since there are about 40 (?) lecture hours in this curriculum the goal is to develop about this amount of Courseware. This will result in about 10000 student contact hours / year, which is an order of magnitude larger than any previously implemented CAI-project.


**Procedure**

The procedure that was followed has largely been influenced by the research on 'Intelligent' Tutoring systems that has been a part of the faculty's research programme from the early 80's. Thus it was felt necessary to get a thorough understanding of the problems and underlying misconceptions that student at the faculty had with regard to the course of Statistics. Two members of the Courseware development team participated in the forementioned working groups, taking notes of each topic treated and of the discussions going on in these groups. Each problem mentioned in these protocols was analyzed on underlying misconceptions or as being due to missing knowledge (eg. missing mathematical knowledge). Also a dependency map of the subject matter was made. This dependency map reflects how concepts of the domain were dependent on eachother. The major focus at this stage of the project was on the didactic aspects.


**Didactic principles**

The major trend that was apparent in the protocols of the working groups was that students experienced the Professor's courses as too abstract. It was clear that the subject matter for these students did not root in their empirical every day experience. Therefore a first general didactic principle was formulated:
1. Each topic should progressively be treated from concrete towards abstract.
It was decided that each topic would have three levels of representation namely: a. concrete, b. graphical and c. formal.

Furthermore, since there seemed to be no relation of the relevant concepts with direct experience of the student, it was felt necessary to give the student the oppportunity to 'play with' or manipulate datasets in order to directly experience the results of these manipulations on the relevant concepts. So:
2. Direct manipulation of the data with immediate feedback is stimulated.

Finally it was clear that the treatment of the relevant concepts in the working groups did evolve along the lines of a 'genetic grah' or dependency map starting with the most central or fundamental concepts. But also that it was necessary to have the possibility to fall back into areas of the subject matter that had been treated before. Apart from this, a general heuristic, which is given with respect to CAI, is that a student should know at any moment his/her position in the 'genetic graph'. These observations lead to the pollowing principle:

3. Concepts are intially treated sequentially according to their position in the 'genetic graph'. This graph can be requested on the screen by the student at any moment and he/she is allowed to jump at any place in the graph <u>but only if it has been visited before</u>.

## Implementation

After an analysis of the available authoring environments the package 'Course of Action' by 'Authorware' was selected as the most suitable. It was felt that this package allowed more efficient implementation than traditional packages (in our estimate the time to implement 1 hour of courseware with this package is closer to 50 hours than to the 100 that is generally quoted as a realistic figure). Thus our focus was on preparation (spending more time on the didactic aspect than is generally done) rather than on actual implementation. We have the expectation that this choice eventually will not dramatically reduce the costs of one hour Courseware but will have a major influence on its quality. The language which is part of the authoring environment is rather simple (most time/effort goes into graphics design anyway) and we felt that it was therefore unnecessary to have a special software-specialist within the team. Instead both members of the Courseware development team (psychologists) followed a special training in the US.

At present, Courseware dealing with concepts related with variance have been implemented (see appendix). This has been done in the form of rapid prototyping with the goal to have something to show to the Professor's teaching the subject matter. In the next phase of the project they will be closely involved in the development of the Courseware. It appears that funding is found to replace them partially for half a year in order to get them committed to the project. We feel that this is absolutely neccesary.