Experiences with the innovation of an Autonomous Systems course

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Abstract

The course on the Organisation and Design of Autonomous Systems is given at the University of Amsterdam since 1995. Every year there were innovations, which could be on the content, the pedagogic approach, or the on-line support. This year we had two novelties: the migration of the on-line support to the Blackboard environment and the introduction of a project assignment instead of a practicum and a writing assignment. In this article we will summarize our experiences.

Keywords: Practical Experience, Project Assignment, Web-support.

1 Introduction

The course on the Organisation and Design of Autonomous Systems (OOAS) [2] is given for graduate students in Artificial Intelligence (AI). It is quite unique in the world, because it makes a bridge between the Engineering approach as taught in the USA, and the Cognitive approach which is the mean stream in the Netherlands. The course is given by six lecturers, who have co-operated quite extensively to prevent that the course became a kaleidoscope. Originally, the course was accompanied by a practicum, which was supported by a single assistant. This year this work was replaced by a project assignment, which meant that we needed six supervisors. The course is popular enough to attract students from other programs and universities.

2 Content

The goal of the course is to learn the basic concepts of an autonomous system. An autonomous system is a system that on the basis of observations reasons, which leads to decisions concerning autonomous task-related behaviour.

The different concepts are worked out in twelve different chapters, with the following titles:

1. Introduction
2. Intelligent Autonomous Systems
3. Concepts for Autonomous Systems
4. Functional Architecture
5. Operational Architecture
6. Implementation Architecture
7. Representation and Modeling
8. Perception for Autonomous Systems
9. Sensor Data Fusion
10. Reactive behavior
11. Planning
12. Multi-Agent Systems

Together they form a syllabus of more than 300 pages. The separate chapters are also downloadable from the web, which is done often (see Figure 1: the number of participants was 31).

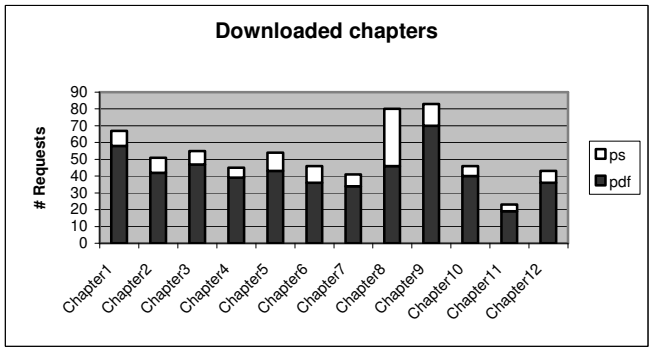

Figure 1: The number of downloads of the chapters over a 15 months period.

The chapters were available in two formats: postscript (ps) and Adobe's portable document format (pdf). Although the latter format was clearly more popular, there is still support for postscript in the AI student population.

The lecturers gave twice a week college over a period of ten weeks, which resulted in total of 17 contacts of 2x 45 minutes. The college was well attended, with typically 20 listeners in the audience (65%). The course was rated as 10 ECTS credits[4], which is 280 hours of work. Half of this time should have been spent on the college, the syllabus and the final examination.

The textbook and the lectures have been the constant pedagogic factors through the whole period of 7 years.

3 Web-support

The course is supported with a website from the beginning. At that time, 1995, this was quite new. One year later, in 1996, 8.4% of the American university courses was supported with a website [5]. To illustrate this, imagine that colour-monitors were still not standard on workstations of the University, so the site was originally designed also to work on a black &

white monitor. Although the site was well maintained over the years, this inheritance is still visible (see figure 2).

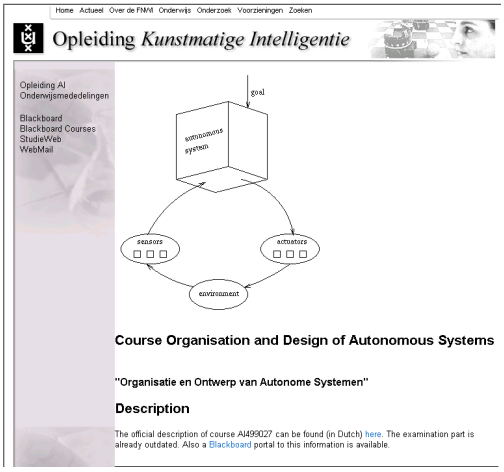

Figure 2: The look of the course's website.

In 2002 the website of the department was upgraded from a directory structure to a content management system. Unfortunately, this meant that it was quite difficult for the students to find "old" content, like our course's website. Via the Blackboard course catalogue we gave the students another access-point. Blackboard is the course management system used by all faculties of the University of Amsterdam. For the program Artificial Intelligence six of the seventy courses use the Blackboard system (9%) This is partly due to the early adaptation of the web as support tool by the AI-teachers, because 78% of the courses is supported by a website.

The Blackboard system gave us the opportunity to use some new ways of support. In [1] there is nice overview of frequent mentioned support-features of 275 international courses, and in the following table we have marked the features we had and could add via Blackboard:

Feature	**Available**	**Used**
Course organisation		
Newsflash	Blackboard	20 students
Administration	Blackboard	Access only
Course Outline	Yes	448 requests
Course calendar	Yes, project part	–95 requests
Course catalog	Yes	Yes
Lectures, contact sessions		
External Resources	No	
Slides	Yes, partly	±30 requests
Videoconferencing	No	
Stored video	No	
Self-study, exercises		
Old exercises	Yes	±40 requests
Old examinations	Yes	±10 requests
Interactive exercises	No	
Testing		
Interactive test	No	
Old examinations	Yes	±10 requests
Interactive exercises	No	
Major assignment		
Examples of previous work	No	
External resources	Yes, some projects	Yes
Group areas	Blackboard	11 students
Project process	No, not via web	
Project results	Yes	Peer review
Mentoring, communication		
Group email	No	
Discussion board	Blackboard	Not really
Virtual classroom	Blackboard	Not really

Table 1: the availability and use of several web-support features for different pedagogical categories.

The new features that Blackboard offered were mainly in the group communication domain. Two of the six student-groups made usage of the group communication, although not heavily. Still, the features were appreciated because the usage of Blackboard was stable over time (see figure 3).

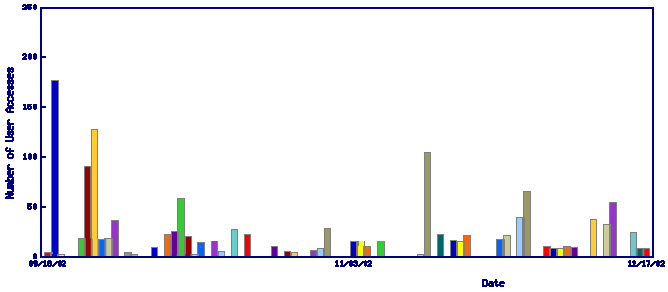

Figure 3: The access to Blackboard over a 3 months period.

The AI students had clearly more than enough experience with general group communication aids, and were not depending on the features Blackboard offered.

So the introduction Blackboard didn't fundamentally changed the web-support of our course. On the other hand, the introduction of Blackboard only costs us 12 manhours.

4 Project Assignment

This year we introduced of a project assignment instead of a practicum and a writing assignment. The writing assignment was always done individual, the practicum assignment was performed in pairs. This year we formed 6 groups of six students, each with a different assignment. Each group was assigned a senior researcher as supervisor.

The supervisor played the role of "problem owner". It was not his or her task to manage the group or the process, but only had to indicate what the expectations were for the different milestones. Still, they couldn't suppress the urge to give the students some extra hints and external resources.

The focus of the project was not on software development, but on research. The students were asked to perform a literature study, to get an impression of the research already performed

in this field and an indication which parts of the problem were solved, and how difficult the remaining parts would be.

Only for this 'critical sections' they had to come with a solution. This solution was implemented, and they tested their implementation to see how far they had come to a solution.

During their research they had to give two times a presentation to their fellow students and supervisor, to show their progress. The students didn't get explicit points for their presentations, the presence of the supervisors and fellow students in the audience was enough stimulation.

At the end they reported their efforts in a sort of conference paper. The paper was sent to their fellow students for review. This is a still innovative pedagogic approach [3, p 23], and a valuable learning experience as well. The exercise of critiquing another group's work in a systematic and professional way was also used to improve their own work. Nearly all students participated in the review process (only two reviews failing), although they did it anonymously and didn't get explicit points for their reviews (in contrast with the recommendation in [1, p. 79]). The review process was supported on the website by making an interactive review-form available.

The supervisors bundled the reviews for their group to a consistent story, adding their own comments in the process. The students had than still two weeks to incorporate these comments in a final version of the paper. The final grade was given to the group by their supervisor mainly based on this paper. To be a fair grade, the supervisors compared the results of the different groups: a discussion that was partly based on the papers and partly on the presentations.

Next to the supervisor's grade, the students themselves also nominated and elected a winner of the students 'Best Paper Award' [6].

5 Results

The result is that this year's course attracted more students than previous years, as can be seen from the next picture. In the previous century typically 20 students participated in the course, while this year the number of 'new' students was 31. This can be due to the change in the pedagogic approach (the project), or influenced by the circumstance that next year a new curriculum is introduced (Bachelor-Masters), or originates from the quality and quantity of this years students.

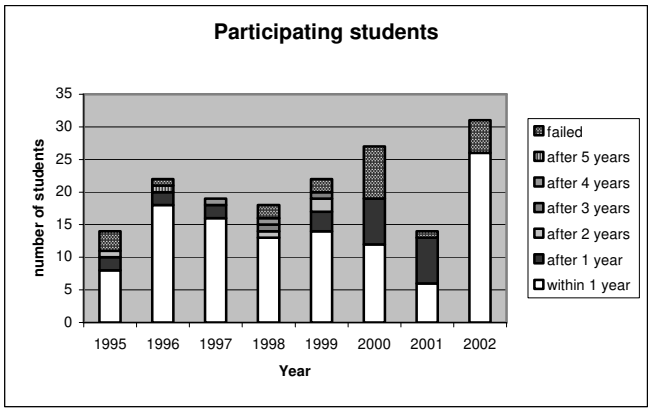

Figure 4: The number of participating students over the years, together with their success rate.

Not only the number of participants increased, also the success rate increased. In the year 2000, an individual written exam was introduced. The success rate (within a year) dropped directly below 50%. With the introduction of the project, the success rate is back on a reasonable level of 84%.

So, the introduction of the project assignment is in its first year a success. We will continue to monitor the course, because we known that a project works well with enthusiastic participants (both students and supervisors), but that in later years a project has to be carefully managed when the participants grow more pragmatic.

6 Conclusion

We described our experiences with a course that is web-supported since 1995. Over those years we have changed the pedagogic approach of this course several times. Most of those innovations could have been done without this web-support, although the support was well used and appreciated. This year we introduced project assignment into the course, a pedagogic approach that really benefits from the web-support.

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