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Perspectives on an integrated computer learning environment

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Acknowledgments

According to the Doctorate Regulations of the University of Amsterdam, a person who wants to be admitted to candidacy for a doctorate must meet the following requirement: “As proof of his ability to pursue independent academic scholarship, he has written a degree thesis or completed an experimental project of equivalent standard.” I am of opinion that academic scholarship in the context of applied research and development in mathematics and science education is displayed by publications in scientific journals, conference proceedings, and teacher magazines. For this reason, I compiled a monograph from such papers. In these papers I presented outcomes of my applied research and development work aimed at improving the contribution of ICT to inquiry-oriented mathematics and science education at secondary school level. I also hope and expect that secondary school teachers in exact sciences find the doctoral thesis in this way readable and interesting. My independency shows up in the following ways: I paid much attention to the mathematical tools in the integrated computer learning environment and I explored applications in various fields, such as physics, biomechanics, and chemistry. I could nourish to my heart’s content my wide interests in mathematics and natural sciences.

Taking longer than usual to finish one’s thesis has disadvantages. But one advantage is to have a chance of collaborating with many interesting people. As a matter of fact, my thesis work would not have been possible without the contribution and support of so many people in so many ways.

I had a headstart in my thesis work through all the preceding accomplishments of the Physics Education Department headed by Ton Ellermeijer, which had resulted in the development and release of the computer learning environment COACH 4 and COACH JUNIOR. This software and hardware environment, distributed by the Center for Microcomputer Applications (CMA), had already become one of the most popular environments in Dutch secondary physics education. It formed an excellent starting point for my research and development work. As director of AMSTEL, Ton offered me ample opportunity to do this in the last decade. It was not always easy to supervise my work, in particular when my work load slowed down the progress and when I drifted far away in pursuit of successful realizations of ideas. Ton, I very much appreciate that you gave me much freedom in my thesis work, continuously supported me, and shared your knowledge, experience and insight in ICT applications in science education. I have good memories of the international projects and workshops in science education in which we engaged.

My work would not have been possible without the unique AMSTEL setting in which researchers, software and hardware developers, technicians, in-service teacher trainers, secondary school teachers, and master students jointly engaged in curriculum innovation, research and development in mathematics, science, and technology education at all levels, ranging from primary school to university. It is a pity that this setting does not exist anymore, but I hope and expect that Ton and my former colleagues Martin Beugel, Vincent Dorenbos, Eva Kędzińska, and Ron Vonk continue the good work of enriching and improving science education with innovative products via the CMA Foundation. I will always feel connected with them.

I am grateful for the support that I received from Cor de Beurs and Johan van de Ridder to realize many practical investigations, profile projects, and outreach activities. Without their support, some of the reported student activities would not have been so successful.

The quality of the practical investigations in the classroom was also much increased by my collaboration with two mathematics teachers, André Holleman and Wim van den Camp. This had been made possible by grants from the Netherlands Organization for Scientific Research in the “Teacher in Research” program. The importance of their contributions to my work is evidenced by the inclusion of four joint papers in this monograph. These papers also give proof of their ability to pursue independent academic scholarship. André and Wim, I was fortunate that I could lean on your shoulders in the development and implementation of classroom experiments. I am glad that you were also willing to accompany and assist me at the defense ceremony.

Special thanks go to Peter Uylings. There has hardly been any activity in physics education presented in this thesis in which we did not collaborate. Although professionally trained as theorists, we shared interests in doing experiments and computer modeling, and in trying out unusual projects and practical investigations. Peter, I miss our Friday afternoon sessions in which we discussed and tried out new ideas in mathematics and science education.

Jasper Bedaux, Nataša Brouwer, and Wolter Kaper deserve my gratitude for the pleasant and productive atmosphere of the many curriculum innovation projects that we carried out. I hope to continue this work in future with Nataša. I am also grateful to Wolter for his many contributions to the Master of Mathematics and Science Education (MMSE). His enthusiasm, experience, and insight in educational research have always impressed me and been a source of inspiration. The same holds for Mary Beth Key. I have never met a university teacher so sympathetic towards her students. We can talk for hours about the students, their educational research, and other issues. Mary Beth, I have always considered working together with you as a great privilege and as one of the most inspiring and joyful activities. I am happy that we can jointly guide the last group of MMSE students to their master degree. All MMSE students, in particular the ones whose research I supervised, offered me the opportunity to broaden and update my perspectives on educational research. I have good memories of the many meetings in which we discussed research issues and at the nice results obtained. I thank all of them for the many interesting and productive activities.

Words are not adequate to thank Leendert van Gastel for his support and companionship. Starting at the CAN Expertise Center, we have shared many career’s joys and sorrows with each other for more than twenty years and yet it is true that there’s never been a harsh word between us. From ‘CAN boys’ we became ‘AMSTEL boys’,

as Sheila Tobias once named us in recognition of our contributions to start AMSTEL and make it successful. Our longstanding companionship in professional life was sadly broken when we took different routes after the discontinuation of AMSTEL. I am very, very grateful for the many years that we collaborated in perfect harmony.

Former colleagues of AMSTEL who do not find their names listed above should not feel offended: Each and every colleague has made me feel at home at this institute and has somehow contributed to my thesis work. I thank all of you for the pleasant atmosphere of work.

I thank Maurice Maas of the University Sports Center of the University of Amsterdam for the collaboration in the organization of the experimental parts of many students' practical investigations and profile research projects. We made the first steps in realizing a sports lab environment for secondary school students to learn about and do movement science. I hope that we can continue and expand these activities.

I am greatly indebted to Jan van de Craats for his support during the entire thesis project and in particular for his help in finalizing the thesis, which proved really extremely invaluable. He read all draft versions of my thesis and gave me helpful editorial comments and supportive critiques. When doubts got the better of me, his encouraging words helped me overcome these feelings and move on. Jan, I can admit now that our weekly Friday afternoon meetings in the past year were probably the big stick that I needed to stay on target and finish my thesis. Our discussions about mathematics education have undoubtedly contributed to my academic scholarship. I have good memories of the many master courses for secondary school teachers in mathematics that we held in the past.

I thank Jan Wiegerinck for giving me the opportunity to continue my work aimed at innovation and improvement of mathematics and science education at the Korteweg-de Vries Institute for Mathematics. I started my career at the Mathematics Department of the University of Nijmegen and working again at a mathematics department feels like home coming. I am also grateful for the hospitality that Mary Beth Key and the students of the MMSE program partake of the Korteweg-de Vries Institute. This makes it easier to bring this study program to a favorable conclusion.

Last but not least, I thank my parents for all their love and support. Words fail me and are not needed to express my gratitude.

André Heck
December, 2011.