

The Education of Automotive Engineers to meet the demands of the 21st Century



A report from the
FISITA International Educators Seminar
2010



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Introduction

On 01 June 2010, FISITA organised its second Educators Seminar in Budapest, Hungary. The theme for the Seminar was *The Education of Automotive Engineers to meet the demands of the 21st Century* and the event was chaired by FISITA Education Vice President, Matti Juhala of the Helsinki University of Technology. The Seminar attracted over 60 academics, educators and industry professionals who discussed the challenges around automotive engineering education.

The aim of the Seminar was to give engineering educators the opportunity to gain fresh insight into the current and future needs of industry with regard to technology and wider competencies, helping them to ensure the relevance of their courses and the employability of their graduates.

There were five presentations:

Prof. Christopher Onder ETH (Swiss Federal Institute of Technology), Zurich discussed opportunities and risks of various types, curriculum content and teaching technologies. The experience of ETH Zurich with Formula Student projects, consequences of Bologna process and balancing the demands of the conventional Bachelor-Masters students and industrial partners were explored.

Prof. László Palkovics Budapest University of Technology and Economics, Budapest outlined a number of projects in which universities worked collaboratively with his former employer, braking company Knorr Bremse, and described the benefits of such partnerships for both parties. He described how Knorr Bremse set up their R&D Unit within Budapest University, which resulted in the same engineering efficiency levels as anywhere in the company, but at lower cost and with much greater flexibility. The university benefitted by gaining lecturers from industry, plus the opportunity to send students on industrial placements and practical semesters.

Prof. Dr. Werner Stednitz University of Applied Sciences, Berlin described how his institution has integrated industry placements, international student exchange programmes and Formula Student into its curriculum. This has led to close collaboration on industry-led research projects and giving the university the opportunity to contract lecturers based within Daimler, Continental and other automotive companies.

Dr. Christoph Anz Director of Education Policy, BMW Group outlined how the company cooperates with higher education institutions in order to recruit and retain the best quality engineering graduates.

Martina Herlyn AutoUni, Volkswagen AG described how the VW Group set up this unique corporate university within the company to promote both personal development and core competencies of selected professionals and executives.

Following the presentations, there was a 40 minute discussion in which participants put questions to the speakers.

All presentations can be downloaded in full from www.fisita.com/education

“The car of the future will not be shaped by engineers who are comfortable only within their *own* discipline. Today we are seeing a convergence between mechanical and electrical engineering; between hardware and software issues; between vehicles and communication systems. This means that tomorrow’s engineers are going to need a different *kind* of preparation to be successful in their careers. And as the world body for automotive engineers, we have to play a part in these discussions.”

Christoph Huss
FISITA President

Discussion

Funding priorities – teaching vs research

Dr. Juan Garcia Applus IDIADA Group asked the panel if they thought the competing priorities for lecturers had a negative impact on the learning experience of the students. Dr. Garcia cited his own country (Spain) as an example, stating that many lecturers are judged by the quality and quantity of papers published, while at the same time they are required to improve the training and learning curve of their students. He asked the speakers if this was recognised as a problem throughout Europe and if so, what would be the impact for students in the next 10 years or so.

Prof. Christopher Onder agreed that this was a problem in Switzerland and argued that the solution to the first part of the problem lies in the ability to attract high quality PhD students who can work in the university laboratories, since the quality of their work will often determine the amount of external funding received.

Prof. Dr. Stedtitz argued that this problem was not Europe-wide because in Germany funding for universities is not solely dependent on the number of publications produced. Instead there are a number of ways in which funding is determined, for example in Berlin the quality of teaching is also a factor. He conceded that this is quite a difficult thing to measure, and one method is to look at the number of students who start and complete a course. He stated that in Berlin the quality of teaching will gain more importance in the distribution of university funding because from 2013 it will account for two-thirds of funding.

Mladenko Kajtaz RMIT University, Melbourne asked Dr. Anz whether BMW is more concerned with the quality of study programme and institution or with the quality of the individual graduate when talking about employability.

Dr. Anz responded that it is not the task of BMW Group to measure employability of individuals. Rather they want to assess the available study programmes. Citing the example of Germany, he said that there is a rating which is well known and used by both companies and higher education institutions to assess the quality of a study programme and the kind of graduates it should produce. This rating uses numerous different targets and evaluation tools which are based on several principles, such as:

- how much cooperation is there between university professors and companies?
- how many internships are obligatory during the study programme?
- is there a board with industry representatives advising higher education institutions?

Dr. Anz stated that this approach has proved very useful for Human Resource departments within German based companies.

Student design competitions: inside or outside the curriculum?

Mr. Kajtaz addressed his second question to Prof. Dr. Stednitz regarding the inclusion of student formula competitions in the curriculum the University of Applied Sciences, Berlin. He said that RMIT did not include student formula competitions in its curriculum, although RMIT did have a Formula SAE team and this extra-curricular work was sometimes included in a final year thesis. Mr. Kajtaz wanted to know if this was similar to the programme in Berlin. Prof. Dr. Stednitz answered that 92–95% of student formula work was considered extracurricular. However, Berlin decided to reward those students who participated in student formula competitions with an accredited subject called 'interdisciplinary team-working' because the university took the view that the student formula work was equivalent to one further term of study.

Prof. John Fieldhouse University of Huddersfield said he believed the learning potential of student formula competitions is diminishing with each passing year. He argued that when the competitions first began, students started with a 'blank sheet of paper' whereas now teams are 'inheriting' designs and fabrication capabilities from earlier students and were therefore not really progressing their own thoughts.

Detlef Frank VDI-FVT & retired BMW disagreed, citing his own experience as a judge for three years at Formula Student Germany which had led him to believe that copying is a low risk because the teams change year-on-year with differing opinions and strategy and each generation wants to do things differently. Additionally, the rules also change slightly year-on-year such that absolute copying is not possible. He believed that the task for student formula competitions is not to develop technology but to develop the student's individual training and therefore it is a worthy event regardless of a team's overall score in the competition. He also pointed out that for those teams who do try to use the work of previous students, judges have experience and can recall work that they have already seen from earlier years.

Dr. Ludwig Vollrath VDI-FVT who is a Board Member of Formula Student Germany said that while it was true to say that some students are more lazy than others, nevertheless it is up to the organisers and judges to ensure that the competitors are tested on the basic mechanics of automotive engineering. Having said that, Dr. Vollrath went on to point out that around 10,000 students take part in these competitions annually. The main purpose was to get students engaged in automotive engineering, and in this respect the competitions are highly successful. Additionally, those students who are running the competitions are also doing valuable outreach to young people by visiting schools and showing pupils that engineering is a very important subject.

Designing curricula for industry requirements

Prof. Fieldhouse moved the discussion to the design of the curriculum for automotive engineering courses, asking whether industry is able to tell institutions what they want from courses. If so, how does this fit with the other constraints facing universities, namely the standards and requirements set by the professional institutions and the research funding bodies? There has been a major expansion in the breadth and sophistication of today's automotive technology. With this in mind, can we still afford to have a generalisation in the first and second years followed by specialisation later on? Should we not now make a decision that automotive engineering students should be taught engineering from year one with mechanical engineering taught within the auspices of automotive engineering?

Prof. Onder responded that his wish was to educate students on 'how to learn' so they acquire the capability to come into a new field and obtain knowledge through papers, journals etc so that they will be able to tackle any problems they are confronted with.

Prof. Fieldhouse agreed, adding that he believed that a primary goal should be to give students an enthusiasm for the subject which means they can 'hang their coat' on a particular 'learning peg'. He used Maths as an example of a subject which is not well understood by most students because it is taught as a separate, rather than an applied subject. Without the application, the peg is difficult to find. Prof. Fieldhouse also made the point that industry could be more involved with regard to the provisions they make to higher education institutions in the form of cars, equipment, facilities and so on. He finished by saying that automotive engineering is a global industry and engineers need to be trained to work anywhere in the world. International exchange and placement programmes were therefore of high importance.

Dipl.-Ing. Christoph Huss BMW, FISITA President asked if it was possible for institutions to be transparent with industry in terms of curriculum offered. Secondly, as international exchange is very important for the career of an automotive engineer, does industry currently support the industrial work placements in the right way?

Prof. Onder answered that in ETZ Zurich, the curriculum is very transparent but at the same time it is taught according to the individual student and linked to each professor, so it is the responsibility of the professor to ensure a good education.

Prof. Stednitz responded by saying that the curriculum in Berlin is transparent as it is on the university's web site and therefore accessible to all; however he pointed out that this does not necessarily mean it is well understood. In response to the second question, he said that one of the main problems with internships (specifically global exchange) is to find adequate funding. He cited Bratislava as an example of an easy placement to organise (from Germany) as costs for travel and subsistence are relatively low. However by comparison, a placement in the US is very expensive and therefore assistance from industry would likely be essential. He suggested that for better understanding, academia and industry should talk to one another more. He added that, although professors in Germany have to have some industry experience before going into teaching, perhaps after a period of 10 years or so they should go back to be 'refreshed' on the needs and capabilities of industry.

Designing curricula for industry requirements

Frank Will Deakin University, Australia said that the core values of his institution were flexibility and transparency. With regards to transparency, Deakin University invites a representative from industry to sit on its board and help determine the curriculum. It is however difficult to find a qualified person from industry who has the time and inclination to play this role. Mr Will offered the opportunity of some 'virtual' collaborative work with any industry representatives in the room who would consider working with Deakin University on programme development.

Prof. Fieldhouse asked if there was a role for industry (along with a body like FISITA) to validate automotive engineering courses to a global standard. He argued that many institutions offer courses in automotive engineering yet the standard varies dramatically. He asked: 'is it time for industry to come together, look at a curriculum and say – this is what industry needs?'

Allen Gullen ACEs, Canada said that in Canada, every province has a professional engineering society which accredits each university to award engineering degrees.

Prof. Dr.-Ing Rüdiger C. Tiemann University of Applied Sciences, Bingen brought the discussion back to the question of higher education funding and how this can affect both the transparency of the curriculum and quality of education. Prof. Tiemann talked about the difficulty of assuring quality of education if one does not have the support of the state administration. Using his own institution as an example, he explained that he received a budget of approximately €100 per student per year to teach five modules in automotive engineering. The university tries to attract as many students as possible and there is a fear that quantity has begun to count over quality.

Seminar closing

Prof. Matti Juhala closed the discussion by thanking the speakers and the participants for taking part. He concluded that programmes such as global internships and student formula competitions provide a valuable space where higher education institutions and industry can come together. However the discussion had made it clear that funding for higher education institutes was a problem (which will only worsen in the current economic climate). Through cooperation, industry and educators must work together to ensure that graduates have the best possible skills sets for now and for the future.

The next FISITA Educators Seminar will take place in Valencia, Spain in 2011.

If you would like to be invited to future seminars, or would like more information on FISITA's work in the education field, please contact:

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