Preparation Doctoral Candidates for a Successful Career in Academia or Industry: The Bit Bang Courses

Yrjö NEUVO\textsuperscript{a,}*, Meri KUIKKA\textsuperscript{b} and Erkki ORMALA\textsuperscript{c}

Aalto University, P.O.B 15600, FI-00076 Aalto, Finland
\textsuperscript{a}yrjo.neuvo@aalto.fi, \textsuperscript{b}meri.kuikka@aalto.fi, \textsuperscript{c}erkki.ormala@aalto.fi

*Corresponding author

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\textbf{Abstract.} Doctoral students are traditionally encouraged to focus their studies on a relatively narrow research topic. In this paper we present a novel postgraduate course for doctoral students that prepare them for working life after graduation, be it in academia or industry, by giving them a wider perspective. The full academic year course is built around multidisciplinary and multinational teamwork assignments, top class guest lectures from industry leaders, and an intensive study tour to a globally recognized region of research, innovation and business. The course adapts Nokia’s top management training program to the academic environment. In this paper we describe the course structure and analyze key learnings from nine years of running the course.

\textbf{Introduction}

Humankind is facing major global challenges like climate change, energy, poverty, and population growth. Meanwhile, science and technology in areas like information technology and materials sciences are developing quickly. Health and environmental aspects bring additional complexity to research and development activities. In these areas, research breakthroughs and their commercialization are increasingly made through multidisciplinary collaboration between research disciplines, or the industry-academia interface. In both cases the innovator’s ability to actively take part in international networks plays an important role [1]. However, doctoral students are traditionally encouraged to focus their studies on a relatively narrow topic [2]. This is not in line with the above mentioned aspects, especially when considering the big changes a young PhD is likely to experience in their working environment during their 40-plus year career.

Large corporations often have intensive top management training programs that enhance collaboration across company divisions and geographic locations. Creating business and technology foresight and increasing understanding of the long term competitive position of the corporation in global markets is emphasized [3]. The authors Ormala and Neuvo have both taken part in \textit{Panorama}, Nokia’s top management training course. The Bit Bang course series is an adaptation of \textit{Panorama} to the academic environment. The name “Bit Bang” comes from the first course taught in the academic year 2008–2009, where the theme of the course was the impact of digitalization on industry and society.

The idea for the first Bit Bang course emerged when the first author, after retiring from Nokia, became involved in setting up Aalto University, a merger of three leading Finnish universities in their respective fields: Helsinki University of Technology, Helsinki School of Economics and the School of Art and Design. The course was established based on the observation that the generic skills taught in corporate management training programs are to a large extent essential in academic environments as well. The first course was a success, and gave incentive to continue the course during the following years.

We believe that the Bit Bang course series also increases company interest to hire young doctors to work on complex challenges. According to Post Docs in Companies, a Finnish matchmaking program
that supports the employment of young PhDs, there is a large variation between countries in the percentage of doctors employed in the private sector [4]. We believe that, for example in Finland, there is a clear need for improvement.

**The Bit Bang Course Structure**

The basic admission requirement to the course is enrollment in a doctoral degree program. Students are selected based on motivation letters answering the question “Why is this course valuable to me?” The annual intake is approximately 24 students and the course aims for maximum diversity across research disciplines, nationality and gender. Typically we have approximately 12 different nationalities attending the course.

In the beginning of the semester the attending doctoral students are divided into four teams of 6 persons each, with maximum diversity among the disciplines, nationalities and genders in each team. This setup lays stringent requirements for the teamwork skills of the students. The semester begins with teamwork training and the topic is revisited in the beginning of the spring semester. During the first two weeks of the semester the teams are asked to propose teamwork topics related to the general theme of the year. The teams then write a scientific article on their chosen topic by the end of the semester. We encourage the teams to come up radical or even controversial topics that they would not otherwise cover in their research.

To promote teamwork skills and maximum exposure to different ways of thinking, the teams are reshuffled halfway through the year. The reshuffled teams again come up with the teamwork topics and write articles. Thus at the end of the course we have eight innovative articles that are collected and published in book form. Each team is supported by an experienced tutor, who is a Bit Bang alumni. Tutoring has turned out to be quite important as student readiness to work in teams varies greatly, and the teamwork paper requires a significant amount of time and commitment.

The class meets on a weekly basis to present and discuss the course textbooks chapter by chapter. Distinguished guest lecturers from industry and academia complement the course literature. The atmosphere of the course supports active participation of all students in discussions and debates.

The highlight of the course is a week-long intensive study tour to a globally recognized region of research, innovation and business. Locations are refined based on the ability of the course staff to organize suitable company and academic visits, as well as cost issues. Over the years the course has visited a number of Asian and North American cities. Prior to the study tour the teams prepare a short synopsis of each company visit, and after the tour summaries of the learnings from the visits are documented in the course publication. The value of the tour is immense, both from the perspective of broadening the students’ view on global developments, as well as strengthening the team spirit of the attendees. One of the greatest outcomes of the course has been the creation of new connections and contacts across the different disciplines and nationalities present on the course, as well as the alumni network that this creates.

The contents of the Bit Bang courses including links to publications are shown in Table 1. Each publication introduces the students, contains the eight group work articles produced in the course, and provides detailed documentation of the study tour. A limited number of printed copies of the most recent Bit Bang books are available from the authors.

Table 1. The Contents of the Bit Bang Courses.
<table>
<thead>
<tr>
<th>Year</th>
<th>Theme</th>
<th>Textbooks used</th>
<th>Study tour location</th>
<th>Link to publication</th>
</tr>
</thead>
</table>
| 1    | Rays to the Future | • Chou, T. (2005). *The End of Software*  
• Christensen, C. M. (1997). *The Innovator’s Dilemma: When New Technologies Cause Great Firms to Fail*  
• Karlson et al. (2003). *Wireless Foresight*  
| 4    | Future of Internet | • Karlson, B. et al. (2003). *Wireless Foresight: Scenarios of the mobile world in 2015*  
• Jurvansuu, M. (2011). *Roadmap to a Ubiquitous World: where the difference between real and virtual is blurred*  
| 5    | Changing Global Landscapes | • MacKay, D. (2009) *Sustainable Energy without the Hot Air*  
• Sharma, R. (2012) *Breakout Nations: In Pursuit of the Next Economic Miracles*  
  - Beijing, China |                          | [https://aaltodoc.aalto.fi/bitstream/handle/123456789/11898/isbn9789526036342.pdf?sequence=1](https://aaltodoc.aalto.fi/bitstream/handle/123456789/11898/isbn9789526036342.pdf?sequence=1) |
  - California, USA |                          | [https://aaltodoc.aalto.fi/handle/123456789/14702](https://aaltodoc.aalto.fi/handle/123456789/14702) |
• Christensen, C. M. & Raynor, M. E. (2013). *The Innovator’s Solution: Creating and Sustaining Successful Growth*  
  - Shanghai, China |                          | [https://aaltodoc.aalto.fi/handle/123456789/17689](https://aaltodoc.aalto.fi/handle/123456789/17689) |
| 8    | Digitalization | • Brynjolfsson, E. & McAfee, A. (2014). *The Second Machine Age*  
  - Seoul, Korea |                          | [https://aaltodoc.aalto.fi/handle/123456789/22535](https://aaltodoc.aalto.fi/handle/123456789/22535) |
  - New York & Boston, USA |                          | N/A |


Discussion

The Bit Bang course has been running since 2008. The course has received an extremely positive response from students and is highly valued by Aalto University. There is definite interest to adapt the course concept for Master’s level students. However, scaling the course to a large number of students would require major changes to the course structure, with the risk of losing some of the benefits. Scaling up the volume would also increase the cost of the course. The course in its current form is already quite expensive to run.

Papers produced by students during their Bit Bang collaboration have produced interesting results: many have gone on to write conference papers and journal articles based on the joint publication written in class. The cross-disciplinary nature of these papers has led them to be picked up by Finnish national media as well, as they are often written on radical topics that spark widespread interest.

The students are given a heavy workload, and working teams are formed to promote maximum diversity among the students. The heavy workload of the class has also led to some dropouts, which can be difficult given the small class size, and the established team roles among the students. To help counteract this, the students are given teamwork training, and a sense of community is fostered among the group by encouraging them to spend time together outside of the classroom setting.

We have now produced 8 classes of alumni, many of whom still actively attend Bit Bang events. The community gathers at the end of each term at the closing seminar in which the research conducted by the teams is presented. As the alumni are scattered around the world, there always seems to be one or two who are located where our study tour is heading. It has been a pleasure to let them participate in the local activities. We are currently conducting a study of the approximately 200 alumni to find out how they currently value the course and how their careers have progressed after graduation.

References


