INDUSTRY BASED PROJECTS AND CASES:
A CDIO APPROACH TO STUDENTS' LEARNING

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ABSTRACT

Just as the media industry, media technology and interaction design are fast moving areas. Even though grounded in theoretical models, the problems that the students face after graduation are constantly changing and contemporary, which makes a CDIO approach to education important. This paper reports a case study concerning a project spanning two consecutive courses with the main objective to renew the digital news platforms of the media group VK Media. The project was carried out in 2013 with students from the five-year Master of Science program in Interaction Technology and Design at Umeå University, Sweden. The results illustrate how project-based learning and real case-based group projects can enhance both students learning and the internal process at the external industry partner. The results clearly show how that not only goals in the CDIO Syllabus 2.0 have been met during the project but also actual value has been created for the industry as the students' design proposals have been implemented and launched publicly.

KEYWORDS

Design-build-test, Case-based, Project work, Value creation, Standards: 1, 2, 3, 5, 8, 11

INTRODUCTION

Learning is much more than a cognitive real-time process. It is, over time, an important platform for all the aspects and skills needed to enable a student's future career. In the late 1990s studies in Sweden emphasized such things as flexibility, industry cooperation and an understanding between (and in-between) humans-technology-society as important success factors for engineering education (Ingemarsson & Björch, 1999). Even though it has been over 15 years, these factors are still more important than ever, particularly in the light of the CDIO approach. However, they are far from obvious in today's engineering education (UKÄ, 2013). CDIO has the aim to bridge the gap that currently exists between engineering education and the business community's view on engineering skills by providing a platform for courses and study programs based on the *Conceive*, *Design*, *Implement* and *Operate* approach (Crawley, Malmqvist, Ostlund & Brodeur, 2007). Hence, the idea is more explicitly to prepare students for a future career in the industry without changing the academic demands placed on students. This model provides a broader base for the generic skills that can be expected by both the engineers of today and in the future. According to Vest (quoted in Crawley, Malmqvist, Ostlund & Brodeur, 2007, p. xiii), "our students should be prepared to live and work as global citizens, understand how engineers contribute to society. They must

develop a basic understanding of business processes; be adept at product development and high-quality manufacturing; and know how to conceive, design, implement and operate complex engineering systems of appropriate complexity".

This paper reports and analyzes a case study (e.g. Stake, 2005; Yin, 1994) concerning a project, with the main goal to renew the digital news platforms of the media group VK Media. The project was executed in 2013 with students from the five-year Master of Science program in Interaction Technology and Design at Umeå University, Sweden. Furthermore, the project was carried out on two, consecutive, courses: *Product development in media technology using the design-build-test method* (7.5 ECTS) and *Prototype development for mobile applications* (7.5 ECTS) and involved traditional project-based learning (Krajcik & Blumenfeld, 2006) and a real case-based group project (Lawrence, 1953) divided over the two courses. The aim of the project was to meet four broad objectives: (1) providing industry linked projects to enhance the learning process and the student involvement, (2) create a better balance between theoretical and practical knowledge, (3) create value for society and the business community, and (4) working with a real case in an environment between industry-academia. Moreover, a number of objectives were broken down and defined for the various stakeholders during the project (Table 1).

Table 1. Stakeholders and objectives of the collaborative project

Students
○ Working with interaction design in engineering projects.
○ Get the theoretical knowledge needed to strengthen the professional role as an engineer.
○ To gain theoretical knowledge of prototype development and mobile platforms.
VK Media
○ Creating new digital platforms for desktop and mobile devices.
○ Facilitate the launch of the paywall on vk.se.
University
○ Build long-term relationships with industry.
○ Strengthen students' knowledge both theoretically and practically.
○ Create results that students can use in their portfolio.
○ Increase the students' employability.

Understanding the media industry and VK Media

Throughout history, the newspaper industry has had an incredible powerful position in the media landscape. As an effect of the invention of the printing press in the mid-15th Century, the industry emerged and grew strong through its ability to spread mass communication of news, i.e. mass media. Although, it retained this position for centuries, technological changes in the media landscape during the 1900s introduced new channels, such as radio and TV. Nevertheless, the most intense competitive pressure on print media came in mid-1990s with the creation of contemporary technologies, such as the www and the mobility of the Internet and social media, in the mid-2000s. This has changed people's willingness to pay for news and influenced the current revenue models of the industry. However, the majority of news companies just started the transition to facilitate and create the digital interaction with their consumers and changing their business models to comply with the new paradigm of media consumption. This student project highly affects this industry, since the business integration on the courses has been with Västerbottens-Kuriren. Västerbottens-Kuriren is a regional newspaper situated in Umeå, Sweden, published by the media group VK Media. The newspaper is distributed six days a week and a website, vk.se, is continuously published

online. As of fall 2014, vk.se is a top-10 local news media website in Sweden (Sveriges Annonsörer, 2014).

METHOD

This paper is based on some basic theoretical assumptions regarding students learning and is, furthermore, deeply funded in the principles of CDIO (Crawley, Malmqvist, Ostlund & Brodeur, 2007). CDIO is an initiative that provides a framework for engineering education. The ideas are to better prepare students for future work as engineers by providing necessary skills not only within the area of focus, but everything needed for life-cycle thinking of products and services. According to Crawley, Malmqvist, Ostlund & Brodeur (2007, p. 1), "the CDIO approach builds on stakeholder input to identify the learning needs of the students in a program, and construct a sequence of integrated learning experiences to meet those needs". Hence, the focus is on the stages: *Conceive*, *Design*, *Implement* and *Operate*.

To work and have a career in engineering, acquiring a broad range of generic skills is becoming increasingly important for students. Due to its ability to support and address both disciplinary skills and generic skills, project-based learning has become increasingly common in engineering education (Mills & Treagust, 2003). Likewise, the use of cases gives the students experience for future problem solving (Kolodner, 1997). Interaction design and media technology are broad interdisciplinary areas within engineering with many different topics to be covered. However, one of the main problems is that "given a finite amount of available time, there are only so many topics that can be explored in depth" (Churchill, Bowser & Preece, 2013, p. 50). Hence, by working with cases and projects, students' inner motivation, need and will to increase their learning in adjacent areas can increase.

This paper is based on a case study (eg. Stake, 2005; Yin, 1994) of the process and the results of two project carried out during two consecutive courses in media technology at the Department of Applied Physics and Electronics, Umeå University, Sweden, during 2013. The two courses - *Product development in media technology using the design-build-test method* (7.5 ECTS) during spring 2013 and *Prototype development for mobile applications* (7.5 ECTS) during first half of fall 2013. The first course is a project-based course (Krajcik & Blumenfeld, 2006) centered around a group project with the goal to provide students with the opportunity to apply knowledge gained in interaction design and media technology to solve a real problem in cooperation with the industry. Projects are prepared and specified in collaboration between the students, academic supervisor and the industry. Along with the group project, theory workshops are held to provide sufficient knowledge on subjects such as business development, project management, service design, branding and presentation technique. During this course a total of four different industry based projects were performed in 2013, however, this case study will only touch on the project in cooperation with VK Media. The second course is based on a real case-based group project (Lawrence, 1953) in parallel with a series of individual assignments to test individual knowledge on mobile prototyping. All three student groups on this course in fall 2013, performed projects with the aim to provide a prototype for a mobile application to VK Media. In contrast with the project on the first course, these projects were mainly performed at the university with support from VK Media, thus, the case-based approach. Representatives from VK Media were available during the project for support, but, in contrast with the first project, the work was mainly done at the University.

The Interaction Technology and Design Study Program at Umeå University is a 5-year cross-disciplinary study program in media technology and interaction design. The user interface

between humans and things and, therefore, its interactions are in focus for the education. The program is firmly rooted in the CDIO approach with courses covering the central and important aspects of all four parts of the Syllabus as well as the CDIO Standards. Hence, in addition to basic and standard engineering courses, the program have courses covering areas like business strategy and value creation, prototyping, development and testing along with using and operating systems.

In parallel with the actual project that the students performed, material for this paper was collected by studying the process of working closely with real-life problems in a real setting and the results of their work. The insights presented are based on both the supervision of the students during the courses and a number of in-depth interviews with representatives from VK Media, conducted during spring 2014. In total the results from the courses were discussed in interviews with nine representatives from VK Media ranging from the CEO and editor-in-chief to journalists, business developers and web developers.

Using case study methodology is a suitable method since this project is a "unit of human activity embedded in the real world; which can only be studied or understood in context; which exists in the here and now; that emerges in with its context so that precise boundaries are difficult to draw" (Gillham, 2000, p. 1). This method has some limitations regarding generalization. Nevertheless, in a case study, Stake (2005, p. 460) states that "the purpose of a case report is not to represent the world, but to represent the case". Therefore, this paper does not aim towards generalization but rather to illustrate a successful case regarding the implementation of CDIO principles in education by real industry cases.

RESULTS

The rapid continuous evolution and development of new technology and changing social behavior has significantly impacted the interdisciplinary field of media technology. Hence, graduated students are facing contemporary complex problems (Churchill, Bowser & Preece, 2013), which is problematic to construct and recreate in a traditional learning environment. Since both the context, learning situation and interactions between students and the business community are of great importance to provide students with opportunities to gain necessary skills for future careers, the goal with the courses and ideas presented in this paper is for the university to provide a platform for combining teaching, real environments and actual problems still inside the boundaries of the academic education (cf. Dearing, 1997; Holmes, 1999).

By combining a larger project with various components over several consecutive courses two main goals have been met: (1) a deeper cooperation have been established with the industry and (2) the students were given an opportunity to use the experience gained in previous projects, thus allowing the experience to be a base for both learning and the outcomes (cf. Kolodner, 1992; 1997). The most noticeable results of this project is the results achieved both in terms of industry and academic results. Ever since the start of the project, VK Media has given the students a great responsibility for renewing their web site. The idea of working with the students has been highly anchored within the company with a strong cooperation with the students and a high involvement from both the CEO and the editor-in-chief. While VK Media has provided the knowledge of how the news industry function, the students have provided the theoretical knowledge and practical skills how users interact with and consume digital media. The most prominent results from the project, in the view of the three different stakeholders are: The students got the opportunity to use engineering skills in a real context,

the university has created a long-term cooperation with the industry and given the students a result that is possible to present in a portfolio to strengthen their employability and VK Media launched two now digital platforms which has, significantly, strengthen their revenue model (Degerström, 2014). The final results (Figure 1) of the project was a new design featuring a paywall launched in October 2013 and a new mobile application launched in March 2014. The editor-in-chief of Västerbottens-Kuriren stated at the end of the project that "the students were damn good!".

Figure 1. Final results of the students' work, as implemented by VK Media.

The readers' use of vk.se, after the students design change, indicates the success of the project work. Since the paywall resulted in the possibility for a digital subscription, approximately 62% (19'000 subscribers) of current readers (as of September 30, 2014) have activated their online accounts and almost none changed from a print subscription (that also includes a digital subscription) to a digital only subscription. Hence, the conversion rate into the new system has been rapid. As of January 2015, vk.se has a total local reach of 48%, which is the highest reach of any local news media in Sweden at the time. This further indicated the success of the students work.

Learning outcomes based on the CDIO Approach

The courses described in this paper aim towards providing learning outcomes that connect to the CDIO standards regarding Context (Standard 1), Learning outcomes (Standard 2), Integrated curriculum (Standard 3), Design-implement experiences (Standard 5), Active learning (Standard 8) and Learning assessment (Standard 11). The project have from the start been rooted in the ideas of CDIO and great results have been achieved within *Conceive*, *Design* and *Implement*. The students have created a project organization and based decisions on current needs and defined all concepts and functions for the interaction with digital news media. They have constructed an innovative design that take into account the trade-offs between goals of users and the company. The final implementation (Figure 1) have been carried out internally by web developers at VK Media. However, the students have worked intensely with factors regarding implementation, e.g. different users' interests, e.g. the users and the journalists. Although only touching the area of *Operate* by e.g. demonstration and some "learning" for the employees at VK Media, a focus with this project has been on also providing base for the extended syllabus and the "Leading engineering endeavors". The students were given an opportunity to work with, and learn from, management teams and focusing on "the creation and operation of the goods and services that will deliver value" (Crawley, Malmqvist, Lucas & Brodeur, 2011).

Table 1. Results achieved according to the CDIO Syllabus 2.0
(cf. Crawley, Malmqvist, Lucas & Brodeur, 2011).

Conceive (CDIO Syllabus 2.0: 4.3)
○ The students have based been their work on actual contemporary needs.
○ The students have defined concepts and functions.
○ The students have taken different goals into account and mediated between these
○ The students have developed a project organization.
Design (CDIO Syllabus 2.0: 4.4)
○ The students have been working according to the design process and everything related to design thinking, this project is in interaction design.
○ The students have used creative thinking and problem solving techniques.
○ The students have used old products for reengineering of functions and design.
○ The students have used standardized prototyping and design tools.
○ The students have used de facto test methods.
Implement (CDIO Syllabus 2.0: 4.5)
○ The students have taken various human stakeholders (internal/external users and operators) for the system has been taken into account.
Operate (CDIO Syllabus 2.0: 4.6)
○ The students held seminars and demonstrations of functions in prototypes and final design before the company's employees.
Leading engineering endeavors (Extended CDIO Syllabus 2.0: 4.7)
○ The students were given an opportunity to work close to, and learn from, management teams.
○ The students focused on creating a product and service that deliver high value for several stakeholders.

Furthermore, other parts of the CDIO Syllabus (Crawley, Malmqvist, Lucas & Brodeur, 2011) have also been met, such as e.g. *analytical reasoning*, *solutions*, *recommendations*, *holistic thinking*, *trade-offs*, *creative and critical thinking*, *self-awareness* and *professional behavior* in Personal and professional skills and attributes (CDIO Syllabus 2.0: 2) and *teamwork* and *communication* in Interpersonal skills (CDIO Syllabus 2.0: 3).

The university as a theoretical workshop and test arena

There are many theories grounding the ideas behind this paper. However, a focus has been on Case Based Reasoning (CBR) (e.g. Aamodt & Plaza, 1994; Kolodner, 1992). CBR focus on personal experience for solving problem, "previous experience[s] might suggest a solution to a new problem or a way of interpreting a situation, […] all types of inferences necessary for addressing the kinds of ill-defined or complex problems that come our way" Kolodner (1997, p. 58). Having several courses that span a longer time period make it possible to use previous knowledge to solve future problems. Furthermore, Learning is supported by interaction with others and in cooperation we can learn more than alone (Elmgren & Henriksson, 2010). Community of practice (Lave & Wenger, 1991) is based on creating motivation through integrating learning and social situations and thus build collaborative learning (cf. Turner & Paris, 1995). According to Bacon, Stewart and Silver (1999, p. 485), "students learn more about teams from good team experiences than they do from bad ones" and therefore the groups on the first course were self-selected. Furthermore, self-selected groups provide a better real-world experience since self-selected groups are likely to be composed of students that complement each other and add value to the project (Chapman, Meuter, Toy & Wright, 2006). Thus, individual performance in combination with collaboration help improve learning (Smith, Sheppard, Johnson & Johnson, 2005; Dewey, 1966). During

the second course students that during the first course had been working with the VK Media project were divided in different groups and the other students were assigned groups.

The students that take these courses have on average two and a half to three years of university education when starting the first of the courses in this project. However, to be able to focus the courses on industry based projects and cases, certain aspects are important to take into account on a theoretical level to give the students the best possible skills. Topics covered during theoretical sessions and workshops are e.g. agile project management, business strategy, value creation, branding, service design, sales, presentation technique and advanced prototyping. These are all areas that well cover conceive, design and operate in the CDIO approach. Still, it is important to notice that the theoretical parts of the course only provide the essential core of the topic at hand, the students must add to the content to be able to continue and successfully complete the project work. (cf. Ying, Yan & Tong, 2010).

To map learning outcomes (Standard 2) towards the CDIO syllabus is of course important, however, on a teacher's level the ideas of constructive alignment (e.g. Biggs, 1996) is also indeed important with alignment of teaching – learning activities – assessment. These courses have several learning outcomes in different levels and learning assessment (CDIO Standard 11) has been taken into account through various methods of testing the students' knowledge. Most of these can be mapped towards the project, when the project purposely is based on the CDIO approach. Nonetheless, due to the nature of group projects, there is a need to, with greater validity, determine the individual students' learning outcome in respect to theory and method. This is done through individual reports and workshop exercises with the aim to practice and test individual students. Yet, all activities have the sole purpose to prepare and support the students' project work and learning according to CDIO.

Teaching and learning are social situations (cf. Lave & Wenger, 1991) and so is the integration of business projects in education. Hence, one major objective of these courses is to create interaction between the teacher and the students, and, furthermore, between the students and between the students and the business community. Dewey (1966, s. 360) explains that "all education which develops power to share effectively in social life is moral. It forms a character which not only does the particular deed socially necessary but one which is interested in that continuous readjustment which is essential to growth. Interest in learning from all the contacts of life is the essential moral interest".

The Industry as an enabler and receiver

By working with real-world cases and industry projects, not only the students receive new knowledge and skills but also the industry. As already mentioned the final results from both courses were implemented and released live. The results from this study furthermore show that the students both provided valuable results at the end of the project and influenced the process of development at VK Media during the project. When the students introduced the method of working according to a structured design process for user-centric development with several different, internal and external, partners, VK changed the way they think about web development. According to one of the web developers, VK Media had "very few visions about the result of the project before the students got involved". Working with the university and with students, made the internal organization more structured and involved in the process than working with a professional consultant regarding web development. The editor-in-chief points out that "the students have thought them that they [VK Media] must be more accurate in the preparatory work [regarding design changes] then they usually are". Furthermore, one business developer acknowledge that user-tests done by the students

made VK Media spot unmet needs that could not be discovered otherwise and that they "have to be better to collect the problems that the users have on their side of the screen". These results clearly show that theoretical knowledge that the students received during their education transferred to the external industry partner for the project. Thus, Industry based cases and projects provide an opportunity for the university (and the students) to be one part in an open innovation process inline with the ideas of Chesbrough (2003). This equal dialogue between the students and the industry partner is creative, contributes to the learning process and is valuable for both parts (cf. Elmgren & Henriksson, 2010).

Moreover, the industry partner enables for the teaching and learning to be put into context, which gives an opportunity for deep learning since "in learning for understanding within a deep approach the student forms wholes corresponding to complex phenomena of the world, including facts and their interrelations" (Svensson, 1997, p. 60).

The visible and invisible hand of the teacher

The students' time and commitment are key resources that must be used well for their studies to succeed. Hence, teachers need to think about what students do in an educational context, but also the learning activities they can engage in when they work independently (Elmgren & Henriksson, 2010). The role of the teacher is important to consider when analyzing the results in this paper. A general view upon the role of the teacher is to provide learning experiences and Duderstadt, (1999, p. 7) states that *"it could well be that faculty members of the twenty-first century college or university will find it necessary to set aside their roles as teachers and instead become designers of learning experiences, processes, and environments".* However, in this case, the teacher clearly has both traditional visible roles and invisible roles in relation to the students.

One of the most noticeable roles is to maintain structure and provide support and advice to the students throughout the project. Other, for the students, visible roles, such as lecturing, supervision and grading assessments, only take up small parts of the total time spent on the course. The more invisible roles are closer to the ideas of the teacher as an enabler of teaching experiences (cf. Duderstadt, 1999), since identifying projects by creating relationships with companies is an important prerequisite for courses with industry based project to be conducted. Working behind the scenes by maintaining contact with companies involved are important to convey an understanding of what the company actually can expect from the students' work and from the academic supervision is also an important task. Furthermore, building long-term relations with the industry is crucial both for current and future project. Lessons learned from project based courses show the importance to gain and nurture contacts at various levels in the external organizations to keep good relations and increase the possibility for successful further use of the students work. The idea of working longitudinal over two courses was successful and gave a deeper involvement with the company and created more value for both the company and the students.

CONCLUSIONS

One of the university's goals with industry based cased and projects, is to increase the students' employability. Even though employability is important for engineering students, it is not everything. Higher education institutions also have a broader responsibility to prepare students not only to get an employment, but also to be able to continue their lifelong learning and to be prepared for new complex situations and technologies. The results achieved during

this project illustrate that by integrating the teaching of professional skills into the curriculum of several courses during the engineering program according to the CDIO Approach, a higher level of engagement from both the students and the industry and actual valuable results can be achieved. Likewise, active learning in a real context of design-implement-test projects make the students more aware of actual problems, moreover, they both work harder and have a more professional attitude towards the project and the results.

By creating long-term relations with the industry, a knowledge transfer not only from the industry and the university to the students but also from the students to the industry might be achieved. This creates both value in the end products delivered by the students but also during the working process.

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REFERENCES

Aamodt, A., & Plaza, E. (1994). Case-Based Reasoning. *AI Communications, 7*(1), 39-59.

Bacon, D. R., Stewart, K. A., & Silver, W. A. (1999). Lessons from the best and worst student team experiences. *Journal of Management Education, 23*(5), 467-488.

Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher Education 32*, 347-364.

Blake, E., Glaser, M., & Freudenthal, A. (2014). Teaching design for development in computer science. *Interactions, 21*(2), 54-59.

Chapman, K. J., Meuter, M., Toy, D., & Wright, L. (2006). Can't we pick our own groups?. *Journal of Management Education, 30*(4), 557-569.

Chesbrough, H. W. (2003). *Open Innovation*. Harvard Business School Press.

Churchill, E. F., Bowser, A., & Preece, J. (2013). Teaching and learning human-computer interaction: Past, present, and future. *Interactions, 20*(2), 44-53.

Crawley, E. F., Malmqvist, J., Lucas, W. A., & Brodeur, D. R. (2011). The CDIO syllabus v2.0. *Proceedings of the 7th International CDIO Conference*, Technical University of Denmark, Copenhagen.

Crawley, E. F., Malmqvist, J., Östlund, S., & Brodeur, D. R. (2007). *Rethinking engineering education: The CDIO approach*. Springer.

Dearing, R. (1997) *Higher education in the learning society*. National Committee of Inquiry into Higher Education. Retrieved from http://www.leeds.ac.uk/educol/ncihe/

Degerström, H. (2014, October 31). VK når fler än någonsin. *Västerbottens-Kuriren*, 10.

Dewey, J. (1966). *Democracy and education*. The Free Press. (First published 1916 by MacMillan)

Duderstadt, J. J. (1999). Can colleges and Universities survive in the information age? In R. N. Katz & Associates (Eds), *Dancing with the devil* (pp. 1-26). Jossey-Bass.

Elmgrem, M., & Henriksson, A-S. (2010). *Universitetspedagogik*. Norstedts.

Gillham, B. (2000). *Case study research methods*. Continuum.

Holmes, L. (1999). Competence and capability. In D. O'Reilly, L. Cunningham & S. Lester (Eds.), *Developing the capable practitioner* (pp. 83-98). Kogan Page.

Ingemarsson, I., & Björch, I. (Eds.). (1999). *Ny ingenjörsutbildning*. Linköpings universitet.

Kolodner, J. L. (1992). An introduction to case-based reasoning. *Artificial Intelligence Review, 6(*1), 3-34.

Kolodner, J. L. (1997). Educational implications of analogy. *American Psychologist, 52*(1), 57-66.

Krajcik, J. S., & Blumenfeld, P. C. (2006). Project-based learning. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 317-333). Cambridge University Press.

Lave, J., & Wenger, E. (1991). *Situated learning*. Cambridge University Press.

Lawrence, P. (1953). The preparation of case material. In K. R. Andrews (Ed.), *The case method of teaching human relations and administration* (pp. 215-224). Harvard University Press.

Mills, J. E., & Treagust, D. F. (2003). Engineering education - Is problem-based or project-based learning the answer? *Australasian Journal of Engineering Education, 3*, 2-16.

Smith, K. A., Sheppard, S. D., Johnson, D. W., & Johnson, R. T. (2005). Pedagogies of Engagement. *Journal of Engineering Education, 94*(1), 87-101.

Stake, R. E. (2005). Qualitative case studies. In N. K. Denzin, & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (3rd ed.) (pp. 695-727). Sage Publications.

Svensson, L. (1997). Skill in learning and organising knowledge. In F. Marton, D. Hounsell, & N. Entwistle (Eds.), *The experience of learning* (2nd ed.). Scottish Academic Press.

Sveriges Annonsörer. (2014). *KIA-index*. Retrieved from http://www.kiaindex.se/

Turner, J., & Paris, S. G. (1995). How Literacy Tasks Influence Children's Motivation for Literacy. *The Reading Teacher, 48*(8), 662-673.

UKÄ. (2013). *Bedömargruppens yttrande över nationell kvalitetsutvärdering 2013 av datateknik, IT och medieteknik med närliggande huvudområden*. Retrieved from http://www2.hsv.se/download/kvalitet/data-it-medieteknik-2012.pdf

Yin, R. K. (1994). *Case study research: Design and methods* (2nd ed.). Sage Publications.

Ying, L., Yan, Z., & Tong, L. (2010). Strategies for promoting better interaction between higher education and IT industry. *2010 International Conference on E-Business and E-Government (ICEE),* 5520-5522.

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