Using Popular Science Summaries to Improve Writing Skills in Master Theses

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Abstract— The Swedish Higher Education Authority has recently launched a quality assurance system which focusses on the learning outcomes of the educational programmes. In particular, the final theses of the students have been given significant attention, leading to an increased interest in the thesis writing process, and the development of writing skills in general.

In Sweden, it is common that the students, in addition to the technical presentation of the thesis, write a popular summary. Often, this summary is written as the last part of the thesis project. In this presentation, I discuss how this kind of popular summary can be used as a means to develop the students' skills in written communication, by introducing it as an early component in the thesis instead of as the final part.

In a reasonably sized department, many students can be expected to do their master theses projects at more or less the same time. Indeed, the current Swedish trend is to aim for a limited number of presentation dates at faculty level, which makes it possible to synchronize several master the- sis students with respect to a written assignment like a popular summary of each thesis project, and use peer review techniques to let the students improve each others written works. The peer review has the additional benefit of demonstrating to the students the importance of analyzing the target group of the text.

Of course they need to learn how to write, but my course is not the place to do it!

(Typical comment from teachers)

Some observations

Regardless of where it happens, we as teachers should recognize some very egoistic motives for improving students' writing skill:

- ▶ Students who cannot write properly take the most time to supervise, and run the risk of highly iterative editing.
- ▶ The thesis is often written in English, second or third language of both student and supervisor.
- ▶ The thesis does not have to be a literary master piece. But if the student cannot write unambiguous text, it is very difficult to even discuss the technical subject matter.

It is desirable to identify any issues early in the thesis process.

Outline

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The Swedish/Lund take on Bologna

| **First cycle** Ability to make autonomous and critical appraisals. | **Second cycle** Ability to integrate and apply knowledge autonomously. | **Third cycle** Ability to undertake autonomous research. |

5 year engineering program · 4 year PhD

There is a progression towards increased independence.

- ▶ Relatively short courses, typically 7.5 ECTS credits.
- ▶ Several participating departments for each programme.
- ▶ First cycle: 3 years compulsory courses (180 credits).
- ▶ Second cycle: 2 years (120 credits), at least 45 credits specialization, of which at least 30 credits advanced level.
- ▶ 30 credits master thesis.

The EIT department context

Teaching environment at the Department of
Electrical and information Technology, Lund
University, Sweden:

- ▶ Programme organisation (many departments per programme, 40–120 students)
- ▶ 84 courses at the department (for 10 programmes), about 70 faculty personnel, equivalent to about 500 full time students per year
- ▶ Most teaching is "traditional", based on lectures, tutorials, and labs

Outline

Historical overview of quality assurance activities

Sweden has had several QA systems the last 20 years.

- ▶ 1995–2001: Audit of the quality *assurance* processes of the universities, not quality.
- ▶ 2001–2007: Evaluations of programmes and subjects. Self-evaluations and interviews. Thematic evaluations (equality, student influence etc).
- ▶ 2008–2010: Reporting of key numbers, extended review of "suspects". Thematic evaluations, Centres of Excellence.

The changes of systems were sometimes motivated by the risk of universities adjusting to the system, and the need for renewal (HSV 2012:21R).

A new quality assurance system

Disagreements between universities and government led to the development of the current quality assurance system.

- ▶ Parliament decision 2010, launched in 2011.
- ▶ Focus on the student attainment of the learning outcomes.
- ▶ Same system for all educations of all faculties.
- ▶ Should be recurrent in 4 year cycles, and may lead to redistributed funding.
- ▶ Only a few of the students' learning outcomes to be selected in each round.
- ▶ Large emphasis on independent projects (master thesis).

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Disagreements led to the resignation of the Chancellor, who preferred a different system.

Elements of the QA system

The quality assurance system has four major parts:

Students' independent projects	Universities' self-evaluations	Students' experiences	Alumni question-naires
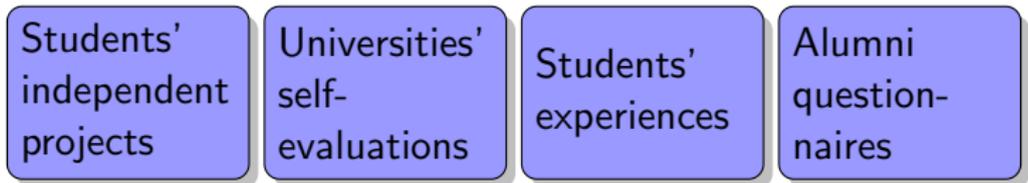
The weighted results end up in a three-level overall assessment:

- ▶ Very high quality: the study programme displays a very high degree of achievement of outcomes
- ▶ High quality: the study programme displays a high degree of achievement of outcomes
- ▶ Inadequate quality: the study programme displays serious shortcomings.

In the last case, the university is given about a year to present its plan to rectify the problems. If not sufficient, the education may be closed. Some funding can be re-allocated.

Criticisms of the system

▶ Too sensitive to individual students.

▶ Lacking in relevance and reliability.

▶ Sweden was expelled from the European Association for Quality Assurance in Higher Education in spring 2014.

> In response to your request of 6 February 2014 to extend the status of "Full member under review" by one year and thus postpone the review until September 2015, I regret to inform you that the Board of ENQA, at its meeting of 19 February 2014, concluded, after a thorough discussion, that the 2-year period for this status cannot be extended.

▶ Revised system under way: Principles for quality assurance at the European level will be considered.

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Some results from an alumni survey (Wendel 2009)

Alumnis and employers were asked about their experiences of the education (all programmes).

Some indicated **strengths** were:

+ Good theoretical basis and adequate basic skills.
+ Develops analytical skills and the ability to "learn to learn".
+ Prepares for further knowledge and personal development.
+ Develops to a very high degree individuals' interpersonal skills.

Some **weaknesses** were

− Does not provide sufficient skills to manage the variation of social situations in the professional life of an engineer.
− **Communicative skills** have weak support in teaching and examination compared to the requirements in working life.
− Training in **written and oral presentation skills** lacks a pedagogical perspective and therefore does not prepare the student to providing information to non-experts.
− A weak contact with industry during training reduces the opportunities to gain insight into the future professional role.

Comments on alumni surveys

- Communicative skills and project management are often deemed important and lacking.
- Should these skills be taught within an engineering program, or be developed later as part of the professional career?

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Formally, the answer is clear: the government has formulated learning outcomes for the education. We need to at least plant some seeds.

Learning outcomes

Typical learning outcomes for a (Swedish) thesis are divided into three categories:

- ► Knowledge and understanding
  - ► The student shall demonstrate in-depth knowledge in the chosen field of engineering.

- ► Skills and abilities
  - ► The student shall demonstrate an ability to identify, formulate and handle complex issues in a critical, autonomous and creative manner,
  - ► demonstrate an ability to be actively engaged in research and development and thereby contribute to the advancement of knowledge,
  - ► demonstrate an ability to plan and execute advanced assignments within given limits using scientific methods conducive to engineering practice,
  - ► demonstrate an ability to integrate the knowledge acquired in key qualifying courses within the programme of study in a critical and systematic manner,
  - ► demonstrate an ability to give a clear account of and discuss orally and in writing his/her findings and the knowledge and arguments on which these are based, and
  - ► be able to identify various sources of information, evaluate the relevance of this information to the problem in question and to be able to use the correct forms of documentation, in an autonomous manner.

- ► Judgement and approach
  - ► The student shall demonstrate an ability to assess his/her own degree project and those of other students with reference to relevant scientific, social and ethical aspects.

The SOLO taxonomy, Biggs & Collis (1982)

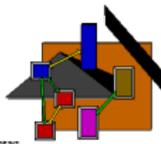SOLO = Structure of Observed Learning Outcomes.

Prestructural
Mentions pieces of unconnected information

Unistructural
Simple and obvious connections are made, but not understood

Multi-structural
Makes several connections, but misses meta-connections and significance to the whole

Relational
Appreciates the significance of parts in relation to the whole

Extended abstract
Makes connections and generalizations outside the subject area

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Before the thesis

How can we improve the students' writing skills before the thesis project?

- ▶ Integrate communicative skills in the programme, typically in the compulsory courses.
- ▶ Encourage them to study good examples and reflect upon them. Write short summaries of research papers in graduate courses.
- ▶ The activities should be designed so that they support the subject of the course(s), not be isolated entities.

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Giving feedback on hundreds of student papers is not to be done in every course. Student peer review can lift some of the load.

Some activities at Lund University

At Lund University, there are currently several projects on integrating communicative elements.

- ▶ Oral presentations in small groups, first year electronics.
- ▶ Project oriented design-build-test tasks in second and third year. Written reports, oral presentations, progression in project management models.
- ▶ New regulations for the thesis work. Strengthening of the popular summary, stronger requirements on style for the report.

Some of these activities already exist in some form, but are now being aligned and clarified.

Some different strategies

OK, a new thesis student has started.

In order to identify any problems the student may have with writing, an early deliverable can be required:

- Early summary of intended thesis strategy.
- Early literature survey and presentation.
- Early popular summary.

Some results from Pelger et al

S. Pelger, S. Santesson, and G. Josefsson, "Science students write popular science", Lund University, 2009 (in Swedish).

Analyzes 25 popular science papers from biology students, and the teachers' feedback.

Some didactic conclusions from their study:

- ▶ Most students have very little training in popular writing from earlier education, and experience difficulties in addressing different target audiences.
- ▶ The students have difficulties presenting evaluative reasoning, and to make speculations on applications.
- ▶ Science students are drilled in briefness and facts, not interpretation and problematization.

Some results from Pelger et al

The students are good at
- formulating informative and striking headings
- writing good introduction paragraphs

The students are not good at
- adapting to the popular science genre
- broadening the perspective
- emphasizing the main point of the text
- making an argument for the relevance of the project
- generalizing and speculating

How does this help the technical report?

Pelger et al: Much of what characterizes a good popular science text also characterizes a good scientific text:

- The rhetorics alternate between specific and general.
- Statements on different knowledge levels (theoretical, practical) support each other.
- Different concepts are introduced as necessary and reused throughout the text.
- There is a high degree of coherency.

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The difficulty is that the actual thesis work is not finished.

Using the literature survey

Basically the same development in communicative skills can be trained using the literature survey.

- ▶ Request an early literature survey, not necessarily complete.
- ▶ Make the student present the survey, and the intended thesis strategy, for the research group.
- ▶ The literature survey can be assessed using, for instance, the SOLO taxonomy. The criteria should be communicated to the student beforehand.

One advantage may be that this is a more natural deliverable in the beginning of the project.

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Conclusions

- Master theses have been a very important part of Swedish national quality assurance the last few years.
- Communicative skills are requested by government regulations, alumni, and employers.
- Different ways of improving writing skills before and during master thesis work were discussed.

Hopefully, this exchange of experiences from the Swedish system can be of interest for others, and help establish an informed practice.

Questions?