REFLECTION IN TECHNICAL HIGHER EDUCATION: STUDENT PERCEPTIONS (SHORT CONCEPT PAPER)

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ABSTRACT

The project 'Strengthening reflection in technical higher education programs' is a response to the need for well-trained reflective science and engineering professionals and the subsequent question of teachers about how reflection can be designed and embedded in a meaningful way, especially in technical study programs. Within this project, eight technical education teams from two Dutch universities of applied sciences are working on improving the use of reflection in their

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curriculum. Among other things, teachers are professionalized in their guidance skills, to improve the guidance of reflective activities of their students. One of the research activities within the project involved a questionnaire to gain insight into: 1) the extent to which engineering students have an inclination and need for self-reflection, 2) the reflection level that engineering students reach according to their own judgement, and 3) how engineering students value (guidance of) current reflection activities in their study program.

In the short (concept) paper we will address some main findings of this questionnaire based on data of 843 first- to fourth-year students from eight technical study programs. Amongst others, results indicate - contrary to some other research findings - that engineering students acknowledge the importance of being able to reflect as a future professional. However, they seem relatively less satisfied with currently provided guidance regarding reflection in their study programs. Also, most often employed reflection activities (i.e., reflection reports) are generally perceived least useful. Results give further direction to optimize activities and teacher guidance regarding reflection within higher (technical) education programs.

1 INTRODUCTION

1.1 Background

Within the current labor market there is a growing need for technically trained professionals. To function well within this labor market, young professionals should be able to critically react to often fast changing (knowledge) developments [1]. More specifically, there is an ongoing demand for technically trained students who are capable of reflective thinking in addition to their domain-specific specialism.

Though reflection as a means to foster students' personal and professional development and the importance of incorporating it as essential part of the curriculum is generally acknowledged [2], schools and teachers also experience difficulties regarding effective implementation of reflection in their programs [3]. Also, related research has shown that especially engineering students not always recognize the added value of reflection and the written format that is often used to incorporate reflection does not fit this technical target group [4].

The project 'Strengthening reflection in technical higher education programs' addresses these issues; eight technical programs from two Dutch institutes for higher education are working together with a project team for the duration of two school years on an improved vision and curriculum regarding the incorporation of reflection in their programs. In addition, efforts are made to improve reflection activities for students and professionalize teachers regarding the necessary guidance skills in order to help their students develop essential reflection skills.

1.2 Current study

As part of the project, a questionnaire was administered to gain insight into 1) the extent to which engineering students have an inclination and need for self-reflection, 2) the reflection level that engineering students reach according to their own judgement, and 3) how engineering students value (guidance of) current reflection activities in their study program. The first two parts are beyond the scope of this article; this paper focuses on the third part of the questionnaire.

2 METHODOLOGY

2.1 Participants

Participants came from two universities of applied sciences in the Netherlands. They were first- to fourth-year students divided over eight different technical study programmes. Initially, a total of 944 students participated in this study. Students who gave no permission for using their data or who did not finish the questionnaire were not included in analyses. This resulted in a final sample of 843 students (M_{age} = 19.9 years; 545 males, 298 females).

2.2 Materials

The part of the questionnaire that aimed to gain insight into the current situation regarding (guidance of) reflection activities consisted of different question types. A first set of items displayed various predefined reflection activities, aiming to provide

insight into how often particular reflection activities are currently employed and to what extent those are considered meaningful by the students. These items were complemented with two open ended questions to determine examples of reflection activities that are perceived meaningful and less meaningful and reasons why they are considered to be meaningful or less meaningful. These questions were followed by seven statements focussing on perceived guidance related to reflection. A final set of five statements addressed the added value of reflection (activities).

2.3 Procedure

Prior to the distribution of the questionnaire, the questionnaire was pilot tested among engineering students who did not participate in the study to determine whether questions and items were clearly formulated. The final questionnaire was administered during a regular class whenever possible. When this turned out not to be feasible, the questionnaire was distributed by a teacher (known by the students) via email or another communication channel with a reminder being sent after a week. At the start of the questionnaire, students had to sign an informed consent, containing information regarding the goal of the research, their voluntary participation, and processing of their data.

3 RESULTS

3.1 (Perceived usefulnes of) currently employed reflection activities

Table 1 provides an overview of the extent to which predefined reflection activities are currently employed within the technical study programmes.

Table 1. Mean scores and standard deviations for currently employed reflection activities (1 = never; 5 = very often)

Reflection activity	M	SD
Reflection reports	3.34	.92
Reflection assignments	3.10	.95
Reflection conversations	-	-
Classroom	2.63	.97
With study career coaches	3.01	.84
With teachers	2.48	.91
With (group of) fellow student(s)	2.96	1.02
Pitches / presentations	2.36	1.05
Other	1.60	1.07

Table 2 presents an overview of the top 5 reflection activities that were most often indicated by engineering students as least meaningful.

Table 2. Frequencies of least meaningful reflection activities

Reflection activity	Frequency
Reflection reports	19.2%
Specific reflection assignments (e.g. games)	12.6%
Pitches/presentations	12.3%
Group conversations (in-class)	11.2%
Specific reflection assignments (personality/talents tests)	8.4%

Reasons why *reflection reports* are perceived least meaningful can be categorized as *only providing socially desirable responses / "fill-in-the-blank assignments"*, *waist of time / taking too much time*, and *no new learning involved / repetitive activities*.

Table 3 presents an overview of the top 5 reflection activities that were most often indicated by engineering students as most meaningful.

Table 3. Frequencies of most meaningful reflection activities

Reflection activity	Frequency
(1-to-1) conversation (with study coach)	19.5%
Specific assignment (other/track specific)	11.8%
Group conversation (project)	10.2%
Group conversation (unspecified/other)	7.2%
Reflection reports	6.5%

Reasons why *(1-to-1) conversations (with study coach)* are perceived most meaningful can be categorized as *gaining more insight from others or being/others held up a mirror, provides opportunities for improvement, provides insight in functioning, tailored towards the person himself/herself.*

3.2 Currently provided guidance

Table 4 presents an overview of statements related to received guidance regarding reflection and provides insight into the extent to which students agree with these statements.

Table 4. Means and standard deviations related to guidance (1 = fully disagree; 5 = fully agree).

Statement	M	SD
I receive clear instruction on what reflection entails	3.33	.89
I receive clear instruction on *how* to reflect	3.11	.94

I receive guidance from my teachers during my reflection proces	2.97	.97
I receive guidance from my teachers that helps me a step forward during my reflection process	2.99	.93
My teachers serve as a role model when it comes to how I should reflect	2.52	.99
I receive feedback from my teachers on my reflection	3.21	1.11
I receive feedback from my fellow students on my reflection	2.69	1.10
I receive clear instruction on what reflection entails	3.33	.89

3.3 Perceived added value of reflection

Table 5 presents an overview of statements related to perceived added value of reflection in general and provides insight into the extent to which students agree with these statements.

Table 5. Means and standard deviations related to guidance (1 = fully disagree; 5 = fully agree).

Statement	M	SD
I think it is important to be able to reflect as a future professional/worker	4.16	.63
I think reflection is an important skill to learn during my program	3.79	.82
When I'm given the task to reflect, it's about things that are important to me	3.46	.87
When I'm given the task to reflect, a connection is made to meaningful (practical) experiences	3.28	.90
When I'm given the task to reflect, I can see the added value of it	3.35	.91

3.4 Concluding considerations

Results indicate that engineering students do acknowledge the importance of being able to reflect as a future professional, apparent from a relatively high score on its corresponding statement. However, when considering the educational context, most often employed reflection activities (i.e., reflection reports) are generally perceived least meaningful. Also, mean scores regarding guidance can be interpreted as relatively low; students seem relatively less satisfied with currently provided guidance regarding reflection in their study programs. On the other hand, reflective conversations with study coaches are most often indicated as most meaningful. This emphasizes the importance of the teacher role in guiding students' reflections, but also indicates that there is room to further improve that guidance. Among other things, these improvements can be about being a role model and providing appropriate feedback as a teacher.

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