

## **Motivation blockers of first year Mechanical Engineering students at the Fontys University of Applied Sciences**

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### **1 INTRODUCTION**

During the first weeks of their first year, it has been observed by teachers that engineering students start with a high level of motivation which often seems to decrease during the course of the first semesters. Such a decrease in motivation can be a main driver for students dropping out of university early.

A qualitative research has been carried out to answer the main questions that have been raised within the engineering department of the Fontys University of Applied sciences: to what extent does a decrease in the motivation of first-year students exists, exactly when during the course of the first half year does this decrease occur and what are the underlying reasons causing this decline in motivation? Gaining more insight in the motivation drop of students could result in modifications to the curriculum in order to help students to see their effort is worthwhile and is leading to desirable results.

The final objectives of this study are to reduce the dropout level of students in the first year and to increase the qualitative results of young propaedeutics.

In [1] and [2] studies into first year Engineering students measuring student's motivation constructs are described. The authors describe a certain level of motivation drop for first year students at an engineering university. In Geraedts 2010 [3] it is defined that Maslow rules for students can be seen as an element of a student's perception onto his or hers education. Often it can be observed that in most cases undergraduates start their education as an unconscious insufficient competent

student having a very limited perception on the work arena and complexity of the engineering discipline. Quickly after the start of the education year this view develops into a more defined perception of what the content and complexity of the future work field is and what is expected of the student during his or hers education. During classes students are being taught the theoretical constructs and are provided with the first insights into the complexity of the theory and work field. In practical assignments students experience even more what the university expects from them in order to gain enough knowledge to pass courses and tasks. The both provide students with more insights in what is expected from them to become a skilled professional mechanical engineer.

This research is a type of action research. The analysis of similarities and differences in the data were used to formulate conclusions. This research is to be seen as a preliminary study where arguments are to be found whether the mentioned hypothesis, that there is a certain occurrence of motivation drop for starting students in the first half year of the curriculum, can be confirmed. Secondly, initial arguments are being sought after what kind of improvements could be implemented in order to reduce losses in motivation.

## **2 PROCEDURE OF GETTING DATA AND BACKGROUNDS**

The first part of the analysis has been focused on the question raised to what extend a reduction in motivation under students Mechanical Engineering exists and if so, in which time periods such a motivation drop occurs.

In total a group of 113 first-year students has been surveyed. This group was chosen consisted of students mechanical engineering of the Fontys University of Applied Sciences in Eindhoven. They started in August 2014. Of this group a total of 67 students, which is 59% of the total population, has responded to the questionnaire. The response of this group, to which will be referred in this paper as the respondents, has been investigated in more detail.

The survey was carried out in the start of the second semester. The questions had been divided into three groups: 1) questions directed towards a possible decrease in motivation during the first half-year 2) questions aimed at the cause of this decrease and 3) questions towards motivation drivers of students.

Several of the motivation related questions were aimed at the amount of effort a student is willing to invest expressed in hours work and the mark target he or she wants to achieve. If students were to indicate that they had an ambition towards a high mark and intention to spend a significant amount of hours on homework than this would be a strategy that is seen as very high motivated. On the other hand, if students would indicate to work for marginal marks and a willingness to spend a minimum amount of hours a week on homework, than this would be seen as a strategy for students with a low level of motivation. So, the strategy students choose to achieve certain marks and spend time on homework is seen to be connected to a certain level of motivation. In

Figure 1 an attempt is given for classifying several stages of strategies.

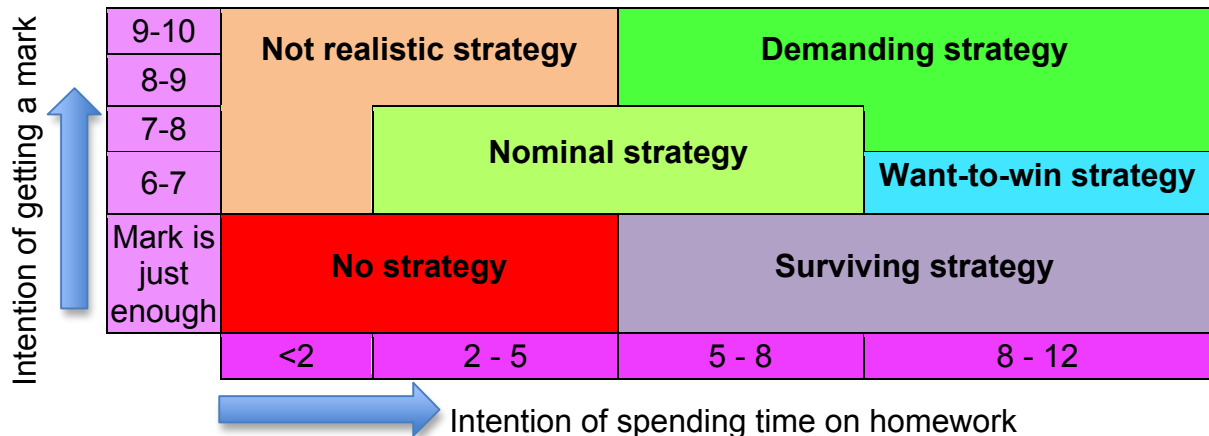


Figure 1: Attempt to classify levels of motivation

In this figure six different student strategies have been defined:

1. Demanding strategy: students want to work very hard in order to achieve the highest marks possible.
2. Want-to-win strategy: students estimate that spending the maximum amount of time on homework will enable average/sufficient marks.
3. Survival strategy: students think they need to work hard for getting an engineering degree. They are aiming for the minimum required grades needed for achieving their degree but are willing to work very hard to achieve this goal.
4. Nominal strategy: students intent to achieve good marks by working a nominal amount of time on homework.
5. Not realistic strategy: students work under the assumption to invest a minimum amount of time into homework for maximum high marks.
6. No strategy: students without specific strategy.

This classification will be used to arrange some of the data as shown later on.

### 3 DATACOLLECTION

#### 3.1 Motivation reduction and recovery

The results regarding reduced motivation are shown in the next figures 2 and 3.

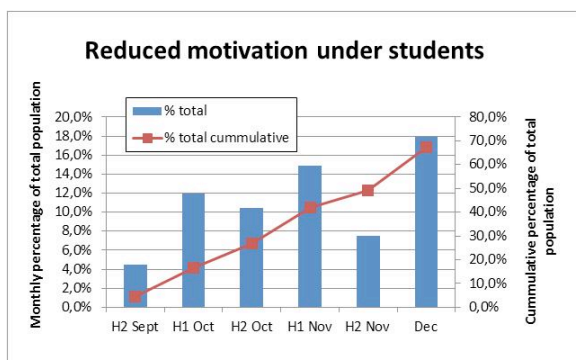


Figure 2: % of total respondents with reduced motivation

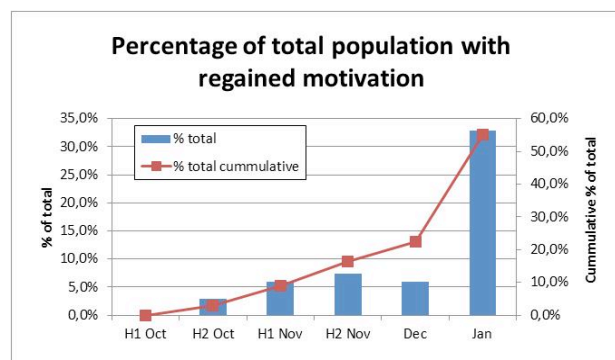


Figure 3: Recovery of motivation

Figure 2 shows the percentage of the total population of students that has experienced a reduced level of motivation during the first semester of the university year. The moment of when this reduced level has been experienced is displayed as well as the cumulative percentage. From the cumulative percentage it can be seen that a substantial part (67%) of the first-year students experiences a reduction of motivation somewhere during the first period. The moment of when this reduction arises is spread over the semester. What is interesting to observe is that early in the year during the first half of October already a sudden increase in students with reduced motivation can be seen. The same can also be seen around the end of the year when 16% of the students experiences a motivation drop.

Next the percentage of students that has been able to recover his or hers motivation has been investigated. In Figure 3 the percentage of the entire respondents group investigated that has been able to regain motivation is shown over time. It can be seen that over the period of October until December around 10% each month of the respondents is able to find its motivation again. In Figure 2 it is shown that on average around 18% each month of the student population experiences a reduction in motivation so roughly half of the group gradually recovers over time. What is interesting to see is that the beginning of the calendar year marks a sudden increase in motivation.

Overall it can be seen that a significant part of the respondents is able to regain its motivation. Over the period that has been surveyed around 67% has experienced a motivation loss whilst 55% is able to regain this motivation.

### 3.2 Motivation indicators using grade willingness and hour investments

In Table 1 three analyses are shown using the definition as presented in Figure 1.

Table 1: Opinions of respondents on their level of motivation/strategy at the start and January and during a possible dip

	Start 65 respondents				Dip in first semester 47 respondents				January 60 respondents			
9-10	9%				11%				8%			
8-9	25%				7%				33%			
7-8	57%				38%				53%			
6-7	2%				2%				5%			
enough	5%				33%				0%			
	<2	2-5	5-8	8-12	<2	2-5	5-8	8-12	<2	2-5	5-8	8-12

The left part shows the result of 65 of the respondents giving their opinion on their level of motivation. In the middle part results for 47 of the respondents that has experienced a reduction in motivation. The right part shows the result of 60 of the respondents stating their level of motivation in January 2015. The latter represents a group with and without a moment of reduced motivation.

From this table one can see that 47 students stated they had a motivation reduction in the first semester. In the figures of these students it can be seen that the 'No strategy' increased from 5% to 33%. This is a significant change in amount of students. Students change into in a strategy mode where they do not want to invest a large amount of time in homework and do not intent to achieve high marks. What is

interesting to see is that these students indicate in January they changed their strategy/motivation presumably to the normal mode. They regained their motivation and want to do their best to achieve good marks.

Secondly, it can be seen that the figures in the tables of the 'Start' and 'January' there is no major difference, except that no students use the 'No strategy' and 'Surviving strategy' anymore. It seems that students partially regain their motivation. It also seems that part of the students have changed from being unconscious insufficient competent to conscious insufficient competent and they choose to put more effort to the results of their education.

### 3.3 Prior education levels and study difficulty perception

In the survey the education level of students that experienced a motivation reduction has been investigated in more detail. The different levels of preparatory training that have been distinguished are as follows:

- 1) MBO - Intermediate vocational education. This vocational education is very much aimed at practical technical application. Focus on analytical and theoretical education is minimum at this type of technical education.
- 2) HAVO - school of higher general secondary education, which should fit a university of applied sciences such as Fontys quite well.
- 3) VWO – pre university secondary education more focused on academic sciences.

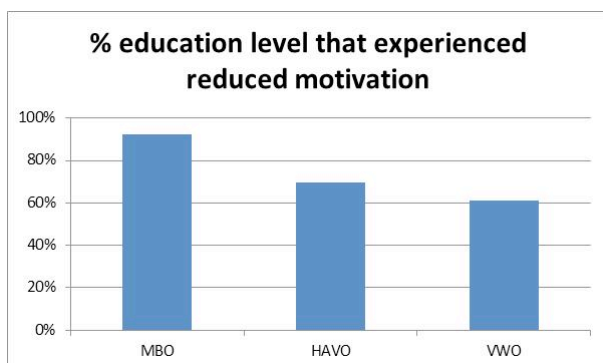


Figure 4: Different preparatory training levels with reduced motivation

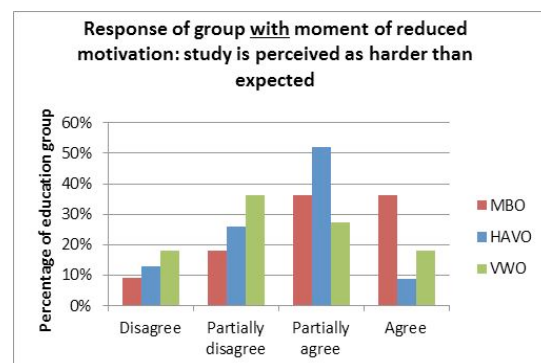


Figure 5: Perception of difficulty for different preparatory training levels

In Figure 4 the percentage of students for each pre-education level that has experienced a reduction in motivation is plotted. It can be seen that the education level prior to starting mechanical engineering at the Fontys University is related to the motivation of the student. Of all MBO students that responded to the survey, 92% has experienced a reduction in motivation. For higher levels of pre-education this percentage is lower at 70% and 61%.

As this might be an indicator regarding the perception that students have towards the difficulty of the study a second plot has been made as shown in Figure 5. Here the response of all students has been plotted on the question if they perceived the study to be harder than was expected at the beginning of the year. Here a clear differentiation towards the groups that did and did not experience a loss in motivation has been found. From this plot it seems to be confirmed that the difficulty of the study is related to the level of motivation of a large part of the first year students. What is striking is that besides the group of MBO students, of which it is to be expected that

they experience the study as harder than expected, also a large part of the HAVO students (52%) indicates a more complicated study than expected.

### 3.4 Root causes of reduced motivation

#### Introduction

In investigating potential root causes of any motivation loss, several main aspects have been included into the survey such as:

- 1) Impact and influence that teachers might have on the motivation levels of students
- 2) Motivation drivers of students

#### Teacher impact on student motivation

Teachers not only are responsible for guiding students through the contents of the courses, they also have a significant impact in transferring enthusiasm regarding the professional field of mechanical engineering. Therefore several aspects regarding teachers and their potential influence on students have been investigated. A similar analysis performed on the question if students think they receive valuable feedback showed similar results and is therefore not presented separately in this paper.

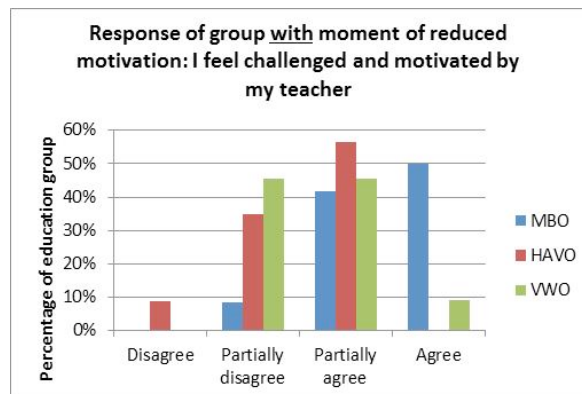


Figure 6: Perception of students regarding being challenged by the teacher

Also here a differentiation in pre-education levels is made from lower (MBO) towards the highest (VWO, pre-academic) level. Interesting to observe is that students with the highest pre-education level (VWO) indicate they are not fully motivated and challenged by their teacher (45%). Also 43% of the HAVO students has given this response. Students with the lowest level (MBO) disagree to the statement to a far lesser extend (9%). The above could be an indicator that (at least part of) the root causes of VWO and HAVO student's motivation lies in the fact of being insufficiently challenged. However when investigating these numbers more closely it can be seen that of the HAVO students 17% indicates the study to be more difficult than expected. This could mean that 26% of the HAVO students with a motivation loss is insufficiently challenged. For the VWO students around 18% has indicated to find the study to be more difficult than anticipated leading to 27% of these students with a motivation loss with a possible cause in being insufficiently challenged.

#### Motivation drivers of students

In the survey students were also asked for their main motivation drivers. For the group that did experience a reduction in motivation these responses have been categorised and shown summarised in the next graph below.



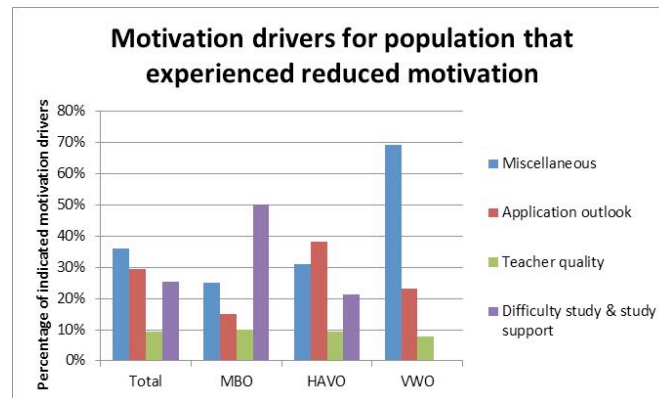


Figure 7: Categorised motivation drives for the motivation-loss group

From this figure the following observations can be made:

- 1) For a large group of students the correlation of study theory with the actual professional field as well as the profession outlook is important. Especially the HAVO and VWO students seem to indicate this is something that should be improved on. Improvements could be found in for instance organising more field trips to companies and to improve the correlation of theoretical subjects with real life work situations. It should be noted that in the survey students also indicated that theoretical classes and practical classes corresponded well. Results from Figure 7 would therefore indicate that the practical classes themselves have insufficient relation to the actual work profession of the mechanical engineer.
- 2) As concluded from the previous results, MBO students confirm that the level of difficulty of the study has a negative impact on motivation. In addition from Figure 7 it can be seen that providing more support and guidance could improve their motivation levels. This group requires more help and inspiration from teachers. What students indicate is that they need more guidance in study discipline, study strategy and work effectiveness and efficiency.
- 3) Teacher quality is perceived as an overall item that could help improve motivation levels although this is not seen as one of the main aspects that can improve motivation. Correlating this to the previous results (see Figure 6) this would mean that students are looking for more motivation coming from their teacher and more feedback during the theoretical and working courses. It seems students perceive the teacher as someone to guide them through the knowledge to be gained.

#### 4 CONCLUSIONS

From the data analysed the conclusions are summarised below:

- A substantial part (68%) of first year students mechanical engineering experiences a reduction in motivation during the first semester
- A substantial part of students that does experience some kind of motivation loss is able to recover from this loss although the highest motivation levels are not fully regained.
- Students (around 25% of the group with motivation loss) with the higher pre-education level (HAVO and VWO) need to be challenged more in order to maintain their motivation.
- Some indicators of root causes regarding motivation loss are:

- The level of difficulty of the study is perceived as being high. This applies especially for students with MBO (lowest entry level of pre-education) pre study level but also for part of the HAVO students.
- Lack of outlook into the future professional work field.
- The view of students regarding marks that should be aimed for and the amount of home study that needs to be invested is largely unchanged before and after a reduction in motivation. Although part of the highly motivated students lose some motivation this means that the students attitude towards study strategy is unaffected by the temporarily motivation drop.

## **5 IMPROVEMENTS OF CURRICULUM IN THE FIRST YEAR**

Using the newly gained insights regarding motivation loss and the possible underlying root causes below some possible preventive measures have been defined:

- Increase the use of practical applications during theoretical courses.
- Modify projects with limited professional outlook into projects with a clear industrial/company connection.
- Organise more field trips to technical companies and increase the amount of lectures given by companies.
- Conduct entry interviews including a test in order to identify earlier what the intrinsic student motivation is and to support the student in defining a learning strategy.
- Modify the MBO group course strategy for complex theoretical courses in the first year. This modification could be aimed towards more support in solving technical assignments and less towards lecturing theory which students should master themselves individually.
- Because the levels for pre-education of students differ significantly it could be considered to define two different study routes in the first year.
- By early on identifying the intrinsic motivation and study strategy of students specific curriculum additions could be considered already in the first year. Examples of such additions can be for instance 1) To offer an honour course for demanding strategy students 2) Setup a student assistance program in which e.g. third years students are used to support first year students in making technical assignments for the most difficult theoretical courses.

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