

THE IMPACT OF IMPLEMENTING ONE PROGRAMME-WIDE INTEGRATED ASSESSMENT METHOD

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ABSTRACT

In September 2017, the English-taught, 3-year Bachelor Industrial Design Engineering (IDE) programme at The Hague University of Applied Sciences (THUAS) has changed its curriculum from a linear to a flexible, choice-based modular curriculum, 'Curriculum M'. And with it, one integrated assessment method has been developed for the whole programme, centered around ownership of the students regarding their own learning, and assessing directly and holistically on competency-level. Students decide themselves which six sub-competencies they will prove mastery of, on what level (novice, advanced beginner, or competent), with what proof material from their portfolio library, during which integrated oral assessment (in week 5, 10 or 15 of a semesters). This oral assessment is the only summative method of testing offered throughout the programme. In this paper the first four iterations of the integrated assessment, which are all part of the only mandatory semester 'Basics of IDE' (Boi), are analyzed. Each 'real-time beta-testing' iteration was observed and reflected on, which lead to (minor) changes in the design to be implemented in the next iteration. The expectation was that the assessment redesign in the authentic, integrated project-based, active-learning IDE curriculum leads to an increase of students' ownership for their learning process, improvement of study progress, and more lifelong learning aptitude of students. The results of this study indicate that these goals were achieved.

KEYWORDS

Integrated assessment, flexible curriculum, oral assessment, competency-based learning, standards: 2, 3, 10, 11, 12

INTRODUCTION

The English-taught, 3-year Bachelor programme of Industrial Design Engineering (IDE) at The Hague University of Applied Sciences (THUAS) has changed its curriculum into a flexible, choice-semester-based curriculum in September 2017, named Curriculum M. The former,

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linear curriculum was already in active learning format, with authentic projects with real clients and users for students to learn to interact with. Each module of ten weeks offered such a project, supported with knowledge and skills courses and project tutoring. Students received feedback on their work and process during the first weeks, and also during assessments. Typically, students would have four assessments in week 8 and 9 of each module: delivering the project results to the client and tutors and doing assignments and/or written exams for each supportive course. The different assessment methods were aligned with the learning goals and activities. The project results were graded on both process and end result per group, with the possibility to deduct or add grade-points for individuals. Course work and exams could be either individually assigned or group work. In Curriculum M, the three years are divided into six 20-week semesters. After the first compulsory semester from September till February of year 1, students choose four semesters from a thematic menu, offering authentic either in-depth design challenges or multidisciplinary innovation challenges, with supportive workshops for knowledge and skill development. They finish with a graduation project semester at a company, organization or the student's own enterprise.

Problems with assessment in the linear curriculum

The linear curriculum of IDE scores high on CDIO-standards such as the context, learning outcomes, integrated curriculum, introduction to engineering, design-implement experiences, integrated learning experiences, active learning, and learning assessment. Nevertheless, several problems related to the programme's assessments exist. First of all, study progress is far from optimal. Drop-out rates after the first year of studies in the linear curriculum are around 19%. Around 40% of all first-year students in the past three years got their propaedeutic diploma in 1 year (which means all credits offered that year), and around 50% of all first-year students manages to finish the 3-year programme within 4 years (Visser, Hallenga-Brink & Kok, 2018). Although these percentages are not uncommon for Dutch undergraduate engineering education, IDE has a need to improve the assessment system in order to improve student success rates. Students in the linear curriculum show difficulty to prepare simultaneously for 4 assessments at the end of the module and pass them all. Often group stakes are prioritized, and the project results are delivered, but individual assignments and most often written exams suffer. Either students try without preparation for the latter, in case they may pass after all, or plan in advance to do the exam at the resit-moment ten weeks later (one week after the assessments of the next module). Some students pass the group work, benefitting from the group level, but have more difficulty with the individual work. These occurrences cause study delays, negative binding study advices (when the minimum of 50 EC has not been reached within a year) and drop-outs.

Secondly, IDE offers competency-based education. However, assessment in the supportive courses is done on course-specific learning goals of knowledge or skills. The competency profile of IDE has been redefined in 2015 in accordance with the national professional profile for industrial design and the CDIO syllabus. This was done to reflect which personal and interpersonal skills, and integration of knowledge and skills within an external context, students need to develop to become futureproof 'designers who can design' (Dekkers, Glerum, & Hallenga-Brink, 2015). After implementation, in 2016, a matrix of the coverage of the redefined competency profile sub-competencies and the learning goals of the different courses and projects of the linear IDE curriculum showed that some sub-competencies were partially assessed as often as nine times during the programme, while others were only touched upon

indirectly once. There is no clear overview of how and when students prove the total of 24 sub-competencies on the 3 pre-defined levels (novice, advanced beginner, competent).

And thirdly, although the project work in the curriculum is authentic with real clients, the assessment design is not authentic. Standard 11 of CDIO focuses on the assessment of student's learning of not only disciplinary knowledge, but also personal, interpersonal, and creation skills (Crawley et. al., 2011). The standard describes how for different kinds of learning outcomes, different kinds of assessment methods need to be chosen, in order to achieve constructive alignment between learning goals, learning activities and assessment (Biggs & Tang, 2011). The varied array of possible assessment methods includes written tests, oral tests (one-on-one exams, presentations), portfolios with (collected) assignments, reports, observations, student reflection etc. These assessment methods aren't equally authentic, when it comes to offering students ways of learning including assessment which are congruent with what their professional engineering career will look like (Mazur, 2013). At IDE, the majority of students direct their activities towards what is asked of them in the assessments, focusing on what (they think) the teachers want them to show, instead of focusing on what innovation really needs. This withholds students from learning the profession in-depth and initiating the process of lifelong learning, while using their talents. A solution would be to start asking those things at the assessment instead, so 'checking the boxes' ensures this necessary proof of competency.

Assessment in the modular Curriculum M

The flexible, choice-based modular curriculum, Curriculum M, has been developed in co-creation with teaching staff, students, alumni and the work field (Hallenga-Brink & Sjoer, 2017). The main vision underlying the flexibility is to educate students who can maneuver in our transitional society once graduated, able to combine their unique talents and interests to become an expert in new areas repeatedly, as each different design challenges demands.

Students learn to master the five main competencies described in 24 sub-competencies on three pre-defined levels, which are the center of the integrated assessment system. The ownership of the learning lies with the students themselves. They prove their sub-competency mastery during one-hour, integrated, oral assessments, which are offered at a 5-week interval, three times per semester. Each assessment is worth 10 out of the 30 EC of the semester. Research shows that students typically start to prepare for an assessment three to four weeks beforehand (Kerdijk, Cohen-Schotanus, Mulder, Muntinghe, & Tio, 2015), so the 5-week intervals will make students study more frequently and prevail procrastination. Also, this research shows that when there is no rivalry of learning activities, students can focus completely and individually on passing a test and results improve. In the assessment weeks there are no classes and no project tutoring, nor any other assessments scheduled. Students pick the time and day themselves for the session from a list, making sure they will not be assessed by their own coach/project tutor. The implementation phase proved there were no scheduling problems, as students followed their own preferences for choosing time slots at the beginning or end of the assessment week, early in the day or later, and at which assessor duo.

The first semester 'Basics of IDE' (Boi) differs slightly from the other semesters: it is compulsory, and instead of three there are four integrated assessments (for 6, 8, 8 and 8 EC). The first assessment in Unit 1 is a smaller version: students need to prove 3 sub-competencies only for a pass. This is done to ease students into the assessment system. Since 90% of the

student population is international, all have just started life as a student, and so far, most have not needed to take ownership of their own learning process yet in the way IDE asks them to.

There are two assessors present at the integrated assessments, who use the programme-wide professional competency rubric, with semester specific indicators that translate how students can prove that particular sub-competency within the context of the chosen semester. This rubric is known and communicated to the student from the beginning of the semester. Students use their contributions to the – authentic, highly challenging, complex, teamwork – project work of the semester, as proof of their sub-competency development. They collect these in a personal portfolio library. The programme applauds students for experimenting and teaches them that failure is part of innovation. Accordingly, the end results of a project are not graded summatively, but only formatively during the workshops, tutoring and the week 15 exposition. It is the process and the ability to reflect on that process that counts. The oral assessment is similar to a conversation a junior designer has with his creative director in a design studio, or project leader in an engineering company. It is based on the portfolio library work the students upload beforehand, including sketches, deliverables, documents, group session results, presentations etc. The students discuss their work and learning process, reflect, answer questions and receive feedback and tips for continuation.

The question is, will this redesign of the assessment of the authentic, project-based, active learning IDE curriculum lead to improvement of student ownership, study progress, and lifelong learning aptitude of the student?

METHOD

A mixed-method educational design research approach is used (McKenney & Reeves, 2012). The integrated assessment design is implemented in the programme, and iteratively prototyped while making the effort to understand and improve what happens. By frequent evaluation and reflection in the iterations, changes are made to the design and implemented in the next iteration. In this paper, the first four iterations, which were all part of the compulsory first-year semester (Boi), are analyzed.

Student Ownership & Study Progress

Data from the student information system Osiris, which THUAS uses for all grade registration, is used to measure the effectiveness of the intervention of implementing the integrated assessment method in the IDE curriculum. The study results of the first half year of the programme from three cohorts (two linear curriculum cohorts 1516 & 1617, and one modular curriculum cohort 1718) are analyzed. Student ownership is measured by the number of students who show up for their first assessment. Study progress is measured by the number of assessments passed at the 1st of February of the first year of studies and the average scores on the assessments, as well as the number of students who still have resits open and the number of resits in total per course. Students who drop out in the first weeks of the programme before being assessed are not taken into account, as their choice was not related to the assessments.

Lifelong Learning Aptitude

Observations of the four iterations of implementing the integrated assessment method are summarized by the improvements and alterations made in the assessment principles and procedure. The initial principles and procedure are the result of a co-creation process by the

IDE teaching staff, educational services from the university, and an independent educational advice agency. Also, other faculties were consulted and their common practices and challenges in oral exams have been taken along in the decisions. During the four iterations, improvements were made based on the output of the following teaching staff team sessions:

- Initial grading rubric formulation: semester specific indicators and portfolio library suggestions (before the semester)
- Grading rubric improvement based on workshop details (in the first week of each Unit)
- Trial assessments: these were think out loud sessions with two assessors and students in presence of all students, (week 4 of Unit 1, 2 and 3)
- Calibration of interpretation of the indicators by assessors (after Unit 1, before Units 2, 3 and 4): The calibration-session with assessors in Unit 1 was a brief walk-through through the grading form. In Unit 2 the assessors looked back at how they had interpreted the rubric during the assessments of Unit 1, and another brief walk-through was organized for the next assessment. In Units 3 and 4 the sessions were also done before the assessment with the workshop lecturers present to share what they had done/would do with the students and what assessors could see back during the assessments.
- Feedback amongst co-assessors based on recordings (after Unit 1, 2 and 3)
- Feedback to co-assessors based on the week 6 semester student-evaluation (quality cycle plus the discussion of the results with students in class), plus the feedback sent by three students on their assessment, including one request to be re-assessed.

The improvements made are used to establish the ability to facilitate the development of lifelong learning strategies by the assessment method.

RESULTS

Study results of 3 cohorts in the first half year of the programme

It is THUAS policy to offer each assessment twice per year. IDE offers a first chance and a resit 10 weeks later in the linear curriculum, and (all) resits in week 18 in the modular curriculum. In Table 1 the attendance at the first assessment opportunity is listed per cohort, as well as the average score per assessment, their pass rate in percentage, and the number of resits which remain open, all halfway the first year, at the start of the new module/semester. The number of students is included, as some students have several resits open. The pass rates for the modular curriculum show the percentage at first attempt plus the percentage after the resit.

Table 1. Study Results of the First Half Year of the Programme

Linear Curriculum	Cohort 1516		54 students, excl. 7 who stopped in the first weeks 11%)	
	Attendance at assessment %	Average score (max. 10)	Pass rate %	Nr of resits open halfway the year
Assessments week 8-9				29 students:
Project Communities	98%	8,3	96%	2
Personal Branding	94%	7,4	94%	3
Cultural Differences	98%	8,7	98%	0
Visualization Communication 1	94%	6,6	93%	4
Assessments week 18-19				
Project Future	87%	7,7	87%	7
Basics of Technology	98%	8,5	96%	0
Mechanics & Mathematics	56%	7,7	56%	23
Visualization Communication 2	76%	6,7	73%	16

Linear Curriculum	Cohort 1617		71 students, excl. 9 who stopped in the first weeks (11%)	
	Attendance at assessment %	Average score	Pass rate %	Nr of resits open halfway the year
Assessments week 8-9				41 students:
Project Communities	100%	6,7	94%	8
Personal Branding	100%	7,1	94%	4
Cultural Differences	99%	7,1	89%	8
Visualization Communication 1	90%	5,6	80%	14
Assessments week 18-19				
Project Future	86%	7,0	83%	12
Basics of Technology	83%	7,0	79%	15
Mechanics & Mathematics	58%	4,1	46%	38
Visualization Communication 2	73%	4,6	59%	29
Modular Curriculum	Cohort 1718		33 students, excl. 4 who stopped in the first weeks (11%)	
	Attendance at assessment %	Average score	Pass rate %	Nr of resits open halfway the year
Assessments week 5				2 students:
Integrated assessment Unit 1 project micro mobility: design methodology, user research, team dynamics, prototyping, product sketching	95% (35 from 37)	6,5	76% - 94%	2
Assessments week 10				
Integrated assessment Unit 2 project micro mobility: design methodology, construction, materials & manufacturing, prototyping, product sketch	91% (32 from 35)	7,2	82% - 97%	1
Assessments week 15				
Integrated assessment Unit 3 project micro mobility: design methodology, business, manufacturing & economics, rapid prototyping, product sketching	100% (all 33)	7,7	84% - 97%	1
Assessments week 19				
Integrated assessment Unit 4 project portfolio: design methodology, personal branding, portfolio design, product sketching	93% (31 from 33)	7,4	86% - resits yet to come	n.a.

While first-test-moment attendance rates in the linear curriculum declined within the first half year, in the modular curriculum they increased to 100%. The average scores on assessments also show an increase, despite the growth in number of sub-competencies that have to be proven. Although in the linear curriculum projects and certain supportive courses had high success rates as well, there were also some courses with typically had many resits still open after the first half year, such as Mechanics & Mathematics and Visualization Communication. The data shows that some students had many resits left. They were unable to show sufficient level in individual assignments but passed group-graded courses and projects. The four iterations of the Curriculum M assessment proved this 'hitchhiking' is no longer possible. Although a student can bring group work to an oral assessment, presenting what happened and answering questions about it takes understanding and involvement of the process. The one student, who again needs to resit three integrated assessments after the resits in week 18, is such an example. Chances are high for this student to get a negative binding study advice at the end of the first year (when passing less than 50EC). 94% of the Curriculum M students will not have to deal with rivaling activities of resits during regular semester activities during the next semester, which in chain reaction improves the chances of success for them. The percentage of students getting their propaedeutic diploma in one year is expected to be bigger this year than the 40% of the previous cohorts.

Changes in the assessment guidelines and procedures along the 4 assessment rounds

In table 2 the iterative improvements of the guidelines throughout the 4 iterations can be seen.

Table 2. The integrated assessment guidelines iterations

Principles for Integrated Assessment in Curriculum M	Moment added/changed	Remarks
Points of departure		
Nominal = normal	Before Unit 1	
Every student is assessed individually.	Before Unit 1	
We expect every student to seriously attempt to pass first try.	Before Unit 1	
There is room for experiment and failure, as long as there is reflection and (suggestion for) adjustment.	Before Unit 1	Re-established after Unit 1, some assessors were inclined to assess quality of end results
Ownership of assessment		
The student is owner of his learning process and results.	Before Unit 1	
Students plan and choose which sub-competencies (SCs) at what level they will prove at what assessment during the semester. In Boi the first two Units are pre-set, to ease students in. In Unit 3 and 4 students choose 5 out of 6 pre-set options.	After Unit 2	Unit 2 proved to be too soon for this, students unsuccessfully tried to prove all 6 SCs, without choosing
The programme-wide competency rubric is complemented with semester-specific indicators for all sub-competencies at the start of the semester, so students can plan	After Unit 4	It was in the design, but not made explicit
The indication of possible portfolio library elements for proving SCs, nor the suggested elements of the indicators, is not a compulsory list to be checked off one by one. They are suggestions, and not an exhaustive list. Indicators should be written on (holistic) competency-level.	After Unit 2	The indicators of Unit 2 were inclined that way, making students just do what the list said, instead of showing their complete, integrated efforts for the project
Students upload their portfolio library work on Blackboard before their assessment	After Unit 1	Next to the audio recordings, this needs to be archived
During the assessment		
There is 60 minutes of assessment time per student.	Before Unit 1	Some assessments in Unit 1 lasted up to 90 minutes, others limited the student to the 60 minutes as was the plan. After Unit 1 the assessors agreed all students get 1 hour of time, no more. Within that hour differences are possible, as some students need more time for feedback, some assessors less time to prepare etc.
A student is always assessed by 2 assessors.	Before Unit 1	The duos were mixed a lot in Unit 1, so assessors would learn with and from each other. This was beneficiary and kept all through Boi
Coaches and tutors don't assess their own students	After Unit 3	At first it said 'coaches' only, who have a double role in Boi as tutors. In other semesters the independence of assessment should be kept this way
There is a clear structure for the oral assessment for both assessors and student.	Before Unit 1	
Assessors ask 1 transparent and clear question per question. Don't hide 3 questions in one and don't trick the students with your questions.	Before Unit 1	
Grading/assessment should build confidence, not take it away. (We help students manifest and realize what they CAN do (not cannot do).	Before Unit 1	Needed re-establishment after Unit 3, where students noticed some assessors were focusing on mistakes they made instead
Grading/assessment should be a dialogue.	Before Unit 1, after Unit 4	After Unit 1 it has been suggested to do the grading with the student present in the room, instead of in the hall-way. Once assessors are more experienced this may be the next step next year.
If things don't go as planned		
For students with special circumstances, extra care can be arranged (in advance) via the student dean.	Before Unit 1	Extra care arrangements executed: let students choose their own assessors, students are allowed to videotape their 10-min. presentation
In case of unfortunate circumstances there is one resit moment in week 18 (+ week 19 in S+1 for Boi Unit 4).	Before Unit 1, after Unit 4	The resits in week 18 did not work in Boi, because there were Portfolio Design classes. This needs adjustment for next year.
If a student disagrees with his grading, or the routine during his assessment, he can ask for reconsideration. Two fellow assessors listen to the recording and look at the student's portfolio library, and give the initial assessors feedback. Then they talk to the student and possibly reconsider the grading, or give extra feedback for the resit	After Unit 2 and 3	Four cases spread over the Units gave cause for this guideline

Some of these improvements lead to an increase in the aptitude of students to develop lifelong learning competencies. Examples are the room to experiment and fail, yet show the learning in that process; the improved scaffolds for the process of choosing the sub-competencies you want to develop in and show during your assessment; the fine-tuning of the indicators to keep students in deep-learning strategies instead of checking the boxes; and the dialogue during the grading process which will be implemented in the next run of Boi.

The procedure's additions and improvements through the Units

In table 3 the same process of iterative improvement is depicted for the procedure of the integrated assessment itself. Like the information in table 2, this procedure was shared with students beforehand, and alterations were communicated during the semester.

Table 3. The integrated assessment procedure iterations

Procedure Integrated Assessment		Remarks
In advance		
-2/3 weeks	Students sign up for a specific timeslot on the lists in area 5.	Next year the signing up process will be digitalized.
-1 weeks	On Wednesday the assessors are appointed to each student and the timeslots are closed. Students can no longer swop.	After Unit 1, the assessor duos were added to the slots first and students enrolled to a time slot with designated assessor duo.
1 day in advance	Student uploads his portfolio library work on Blackboard	After Unit 1 this was deemed necessary and added. A number of students uploaded their work from Unit 1 in hindsight.
1 hr in advance	Student is present at university, to make sure trains or flat tires don't stand in his way.	This worked well
During assessment		
5 min	Start of the assessment, student installs work in assessment room.	After Unit 1: Because of limited rooms available, a desired double room set-up is not possible
10 min max.	Assessors look through student's work while student waits in the hallway.	After Unit 1: if assessors need less time, they are allowed to start with the oral part early.
30 min	Oral assessment, student shows his level of mastery. Student starts with a short (10 minutes max.) presentation, answers questions and gets feedback. The assessment is recorded (audio) for archiving purposes.	After Unit 1 the presentation was added, as not all assessors gave students room for it. After Unit 2 it was decided the presentation could be filmed in advance and shown, for those students who were nervous or less easy talkers.
10 min	Assessors confer about the results while student waits outside the room.	After Unit 1 the idea rose to keep the student in the room, for transparency of grading reasons. Not all were comfortable yet with this idea.
5 min	Results are made known to the student, closing of the assessment.	After Unit 2: when not in agreement with the student, 5 minutes is very short. Also: ask students to take notes of the feedback, and ask him to repeat what he takes home from the feedback and how he will implement this in the next unit.
After assessment		
same week	Assessors register results on Blackboard.	Although this didn't always happen, the team agreed this should remain the rule.
+1 weeks	Semester coordinators process results in Osiris.	After Unit 4: in the near future SCs can be put in Osiris, in which case the assessors can do that themselves directly.

The process of signing in for a certain timeslot proves to functions as the start of the ownership the student feels for having his learning path assessed. Lifelong learning competency is practiced in making decisions on what materials to use as proof, and what to tell about it, instead of checking off a pre-formulated list of deliverables. The student has to decide for himself when he has been ample thorough in his learning endeavors. He practices being on time, structuring the oral assessment, manifesting himself, taking notes of the feedback, and implementing that feedback in planning the next learning activities. All of these are independent activities in the learning context, which the student will be doing as a designer after graduation as well.

CONCLUSION & DISCUSSION

The first four runs with the integrated assessment system show that the choice for one single, integrated assessment format for the whole programme has a substantial impact on the learning behavior of students. The noteworthy increase in attendance of the first assessment moment in the modular curriculum, compared to the linear curriculum, shows students feel more ownership for their own learning, and study progress has improved. As Kerdijk et. al. (2015) indicated, students proved to be facilitated better to persevere and pass all their assessments at first try, with is no rivalry of assessments of other courses, and less room for procrastination due to the 5-week interval.

The set-up of the assessment appeals to the emerging lifelong learning competencies of the student. From the first assessment onwards, students are asked to talk about their work, whether satisfied about it or not, manifest themselves, reflect on their learning, indicate what they will do next, where they want to dive deeper. The choices they have to make help both motivation and the development of a professional identity during their studies (Reekers, 2017).

As the approach chosen for the implementation of the integrated assessment was one of 'real-time beta-testing' and 'learning on the job', and for many lecturers it was a new approach, the calibration sessions and trial assessments - although hard to schedule - were a must. As assessors get more experienced, it will get easier to work with the complete competency rubric and estimate the level of students in a way that is close to other assessors. The advantage of this approach is that lecturers learn more about what each of them does in class, and thus can support the student with more integral feedback as well.

For the purpose of this study, only the impact of the programme-wide integrated assessment on student ownership, study progress and lifelong learning competencies were considered. There are more beneficial factors of influence at work, such as the flexibility, the freedom of choice for semesters, and the authentic projects in which students work with real clients and users. These can be studied as the curriculum progresses. Also, the first cohort of Curriculum M is smaller than a typical IDE cohort and students are halfway the first year of the programme. Therefore, the amount of data is limited. The same data analysis could (need to) be repeated and expanded in the semesters to come. None the less, the results give good hopes for the future.

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