

Continuous Competency-Based Assessment: Impact of Regular Student Involvement on their Performances and Success

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Abstract—Using competency-based assessment (CBA) approaches to evaluate students is gaining in popularity. The work presented in this paper relies on a pragmatic CBA approach integrating the evaluation in the learning process. A specifically designed web-based platform, named TLCA, is used to support the approach. This latter mainly aims at fostering students to be regularly evaluated while allowing the real time monitoring of learners' progress for both students and their teachers.

This research full paper analyses the impact of a regular involvement from learners on their success in courses following the proposed CBA approach. The analyses have been conducted on teaching units from several institutions and taught by different teams of teachers. The presented results are supported by qualitative data obtained from students surveys and quantitative data collected by the TLCA platform on the evaluations. These latter mainly consist of competencies acquisition rhythm all over the year. All the collected data tend to show that the proposed approach does have some positive impact on students' involvement, leading to better performances and success rates.

To conclude, this paper proposes possible ways to improve students' involvement in their learning, based on observations extracted from several experiments with the proposed CBA approach. These improvements do have a direct impact on students' success. Possible improvements to the pedagogical device and the TLCA platform, both for teachers and students, will be considered in future work.

Index Terms—competency-based assessment, continuous evaluation, students' involvement, success factors

I. INTRODUCTION

Competency-based assessment (CBA) approaches are becoming more widely advocated and accepted. They aim at determining whether learners manage to perform tasks related to learning bundles and how well they achieved them [1]–[3], that is measuring whether competencies have been acquired and how well. Recently, they are also gaining in popularity in higher education [4]–[7].

Usually, marks are left aside to directly put the focus on the acquirement of competencies, possibly measured with a level of mastery. This contributes, among other things, to making the evaluation process more transparent. CBA approaches can benefit to both instructors and learners. On one side, it may help instructors to evaluate learners with better assessments, knowing that designing relevant ones is not easy [8]. Also,

the emphasis is put on the definition of assessments, prior to developing teaching activities [9]. Instructors are first focusing on evaluation before working on how they will drive learners towards succeeding them. On the other side, CBA approaches may contribute to change learners' perception of the role of assessments, encouraging them to move from surface to deep learning approaches [10]. Learners often consider evaluations as a reporting tool that is separate from the learning process [11]. However, teaching, learning and assessment should be seen as a whole [12]. With CBA, learners do not put the focus on obtaining good marks but on being able to prove that they acquired competencies, resulting in a deeper learning.

The learning process usually extends all over the semester or year. Assessments being an integral part of it in the proposed approach, they are also usually conducted regularly all over the course period. Introducing continuous evaluation in the approach is a factor of success [13]. As detailed in [14], continuous evaluation has to main cognitive benefits: a testing effect resulting in a better retention and a spacing effect helping for longer retention. The proposed approach of course aims at teaching learners to successfully perform tasks, but also to remember how to do it in the long run. Having assessments as the core element of the learning process also help learners and instructors to focus their efforts on mastering important material, precisely those described by the competencies to acquire [13]. This result in a better alignment between the assessments and the objectives of the course.

For continuous CBA to work, learners' perception about assessment should evolve. Leaving marks in favour of acquired competencies can be a challenge for learners, used to more traditional approaches [15]. However, by carefully designing assessments with tasks that make sense for learners, these latter will better adhere and be more involved in their learning process. Continuous evaluation can imply task overload and complicate the elaboration of an effective work plan for learners, if they are not adequately accompanied [16].

This paper analyses the relation between the regular involvement of students in the learning process and their success for courses with the CBA approach developed in previous work [3]. For this, quantitative and qualitative data have been

collected from two teaching units. The first one focuses on computer application development taught to second bachelor students [17]. Two consecutive editions of this course have been analysed. The second teaching unit is a digital transmission course taught to third bachelor students [18]. The focus in this paper is on continuous evaluation with a CBA approach. The main pieces of data analysed are related to the evaluation and competency acquisition rhythms during the year.

A. Motivation

The main motivation underlying this research is to better understand the impacts of the proposed competency-based assessment approach on learners' performances. In particular, it would be interesting to identify whether the data collected by the web-based platform used to keep track of learners' progress could reveal involvement profiles that are factors of success. Combining objective data with learners' and instructors' perceptions, this work has also as goal to identify ways to improve the proposed pedagogical device and the platform, to foster regular involvement and, hopefully, success.

Previous work-in-progress papers [3], [17]–[19] presented preliminary results obtained from several experiments with the proposed CBA approach, at different institutions. This paper is a first step towards more rigorous and objective analyses of the impacts on students learning process and academic achievement. It also presents a cross-analysis of the experiments carried out by several teachers.

B. Research Questions

The goal of this paper is to analyse whether there is a relation between the rhythm of learners' evaluations and their final academic success, in courses following the proposed CBA approach. More precisely, it is the pace at which students are taking and succeeding assessments all over the year that has been examined in this work. Two research questions are addressed in this paper:

- RQ1** Does the proposed approach foster a regular involvement of learners?
- RQ2** Does a regular involvement have a positive impact on learners' performance and success in a course with the proposed approach?

The first research question wants to evaluate whether learners are encouraged to work regularly and therefore be more involved with courses following the proposed continuous CBA approach. The second one is interested in the possible positive consequence of regular involvement on the success. Combining the answers to both research questions, it may be possible to determine whether the proposed approach drives learners to success, through a regular involvement.

The remainder of the paper is as follows. Section II presents several related work. Section III explains the CBA approach used for the analysed courses. Section IV presents results obtained from the analyses on various collected data. Section V discusses the obtained results in the light of the addressed research questions. Finally, Section VI concludes the paper with future improvements for the proposed approach.

II. RELATED WORK

Several models to develop CBA approaches are being explored. In [1], a conceptual learning model is presented explaining that competencies are acquired based on integrative learning experiences based on prior acquisition of skills, abilities and knowledge. This latter model inspired the work presented in this paper. In [20], the author presents the *Competency and Skills System* (CaSS) that can be used to define and organise competencies into frameworks, and to collect evidences of competencies. The proposed approach is similar in the sense that instructors are collected evidences of the acquisition of competencies by interviewing learners, and encoding in the TLCA platform the competencies for which they manage to prove some level of mastery. In [21], the authors propose a formal language to define competency assessments models. The different concepts defined by these authors can be found in the proposed approach.

Different tools have been developed to support CBA. For example, the *Competency Assessment Tool* [22] (CAT) blog-based platform and the *MyCompetencies* [23] mobile application are used by instructors to keep track of learners' competencies achievement. The first tool has features for instructors to provide feedback to learners and the second one provides information to instructors allowing them to adapt their course while they are delivering them during the semester. Existing Learning Management Systems (LMS) can also be used for competency based education [4]. The TLCA platform is similar to all these tools, but obviously specifically designed for the proposed approach. It is closer to an LMS than the two first presented tools. It could have been developed as a plugin for an existing LMS, but a tailored prototype at this level of the research is a more flexible choice.

Several work are related to the introduction of continuous or in-course assessment to improve students success. In [14], the authors analyse the relationship between different types of continuous assessment (CA) and student characteristics with academic achievement. They show that student achievement does not depend on the type of CA and that students with high level of intrinsic motivation does not benefit from CA. In [13], the author investigates why regular assessment of elementary and secondary schools students can and does improve their academic performance. It is argued that students would benefit in numerous ways from more frequent assessments, especially with diagnostic testing, as it helps both students and teachers to focus their efforts on mastering important material. In [24], the author develops the impacts of regularly using online reflective self-assessments (ORSA) to promote students engagement and academic success. The obtained results reveal that students who completed more than 50% of these self-assessments are almost twice as likely to achieve academic success compared to the others. Among the possible explanations, thanks to the bi-weekly ORSA, students get to engage more with the course content on a regular basis, resulting in a higher chance of academic success. The work presented in this paper has similar objectives, but with the focus put on continuous CBA.

A few work are trying to provide evidences of the relation between CA systems and academic success, based on collected data. In [25], a large study is presented, providing a long-term analytical perspective (on 10 years). The presented results indicate that CA helps significantly to improve students' academic achievements. However, the author highlights that the improvements come with a very complex mechanism. In [16], the authors present ideas to use learning analytics to improve the effectiveness of CA settings. They propose a tool to visualise and track students' progress, to help teachers supporting their learning process. Three aspects to visualise are proposed: the evolution of students' grades over time, comparisons between groups and tracking of dropout rate.

Finally, there are also more specific research, targeted on particular fields. In [26], the authors observed that the combined use of continuous formative assessment, responsive teaching, and effective patterns of variation form a powerful way of engaging and sustaining mathematics learning for students who might otherwise be marginalized by being left behind or not being appropriate challenged. This means that it is possible to drive all the students from a course towards academic success, at least in the situation described by these authors. In [15], opinions of students have been collected about their experience with a competency-based portfolio system deployed for a course in a medicine programme. The authors observed that what destabilised students initially was the lack of grades, seen by them as an "objective" measure of their performance. Also, it was not easy for students to relate themselves to competencies, in the reflective process.

III. COMPETENCY-BASED ASSESSMENT (CBA)

The main idea underlying assessments based on competencies is that they are meant to test whether learners meet the standards of performance required for a given job [2]. According to the conceptual learning model of the U.S. Department of Education, competencies are the result of an integrative learning experience in which learners' skills, abilities and knowledge are interacting to form learning bundles [1].

The goal of CBA is to determine whether learners manage to perform the tasks related to these bundles and how well they achieved them [1], [2], [6]. The NPEC¹ defines a competency as "a combination of skills, abilities and knowledge needed to perform a certain task." [27] Compared to learning outcomes (LO), which are specific statements describing what learners are able to do after completing a course, competencies are more general [28]. In some models, competencies are described based on learning outcomes.

A. Proposed Approach

The competency-based assessment approach used in this work is presented and developed in previous pieces of work [3], [17]–[19]. The proposed approach is a pragmatic pedagogical device supported by a web-based tool. Three

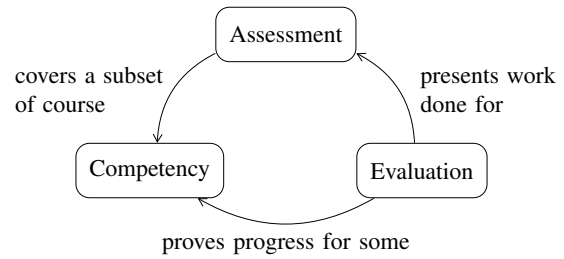


Fig. 1. The three key concepts of the proposed competency-based assessment approach are the competencies, the assessments and the evaluations.

elements are the key concepts used in this approach: competencies, assessments and evaluations. Their roles and the relations between them are summarised on Figure 1.

In the proposed approach, the objectives of courses are described by means of *competencies*. Each course has a list of basic competencies and can optionally have a list of advanced ones. Basic competencies are the ones learners must acquire to succeed the course and they are specific to it. Advanced ones are those for which there are opportunities to make progress on in the frame of the course, but they are not mandatory to succeed the course.

For learners to prove that they made progress on some competencies, they have to work on *assessments*. Several kinds of assessments can be defined by instructors, such as quizzes, missions, study cases, codings, projects, interviews, etc. A subset of the course competencies are associated to each assessment, meaning that succeeding them proves to the instructor a progress made on them. A given assessment can have mandatory and optional competencies. The first ones are related to the main task of the assessment and the latter are associated to optional advanced tasks.

Finally, after learners worked and made the necessary preparations for an assessment, they have to pass an *evaluation* for it. Evaluations can be automated, such as for multiple choices quiz or simple coding assessments, for example. It is also possible to have face to face evaluations between the instructor and the learner, where the latter presents his or her work.

The availability of assessments can be determined by the instructors. They can be available only at one specific time, until a deadline is reached or over the whole duration of the course. Evaluations can usually only be presented at specific time slots defined by instructors. They can either be presented at the request of learners or at a specific time decided by instructors, such as for a quiz proposed to the whole classroom.

An assessment can be worked on by learners one or multiple times, as defined by instructors. Single take assessments can only be presented once which may be suitable for quizzes, for example. Incremental assessments can be worked on until all their competencies are acquired. This allows learners to not fail during an evaluation, but only miss an opportunity to make progress at that precise time. Learners can present again the assessment, with a version of their work improved thanks to the direct feedback received from instructors.

¹National Postsecondary Education Cooperative

To measure the level of mastery of competencies, a five-level scale is used. For each competency, learners can acquire competency stars. They must obtain at least five of them for the competency to be considered as mastered. Through an assessment, learners can obtain one, two or three competency stars for each covered competency. The number of stars that can be acquired depends on the complexity of the task to work on. The main reason for using five stars is to enforce learners to at least present and succeed two assessments to master a competency. It is also a gamification aspect that could motivate some learners to make progress [29]. Other approaches from the literature consist in measuring the mastery level with a mark (generally a percentage) or with a simple binary acquired or not choice, as with portfolio.

B. Teaching Unit Design

The proposed approach can be used in several ways, but there are various design aspects that are similar and intrinsic to the philosophy behind the approach. First of all, a key feature is to propose more assessments than just those needed to exactly acquire five stars for each competencies. This allows learners to choose the assessments they want to work on, hopefully those better fitting their learning profile. Another interesting possibility to propose to learners is to allow them to propose their own assessment ideas. With this, it is possible for them to express their creativity or to value personal work they realised in other contexts. A last important point for instructors is to put deadlines on some assessments and to provide a proposed work schedule ensuring a regular progress.

C. TLCA Platform

A specific web-based platform, namely TLCA, has been developed to support the proposed CBA approach. The main purpose of this tool is to allow learners and instructors to monitor and keep track of the progress of competencies acquisition. More specific features are implemented on the platform. On one side, it assists learners to organise their work, knowing where they are and what they still have to work on, and it provides them with the list of available assessments. On the other side, it helps instructors to monitor their learners and to encode the results of each evaluation.

Following the definition proposed in [30], the TLCA platform is a Learning Management System (LMS). It is indeed an infrastructure that delivers and manages instructional content. More precisely, it makes it possible to identify and assess individual and organisational learning goals, to trace the progress towards meeting those goals, and to collect and present data for supervising the learning process as a whole.

As highlighted in [24], LMS are unfortunately often used only as a content repository (for instructors to put syllabi, handout and traditional assessments), but not to support the process of teaching and learning. In the case of the TLCA platform, the main goal is clearly the support of the learning process. It keeps track of all the evaluations and progress made by learners over time and made them available for both instructors and learners. Figure 2 shows the mastery levels

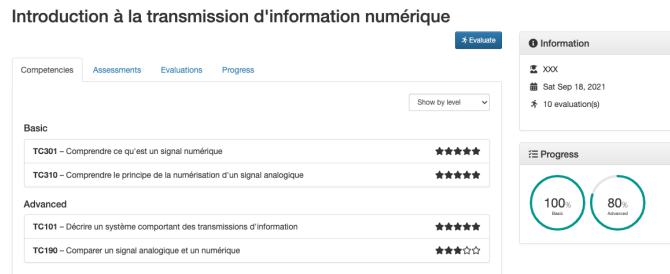


Fig. 2. Instructors and learners can keep track of learners' mastery levels for each competency of the course, from their dashboard.



Fig. 3. Instructors and learners can keep track of learners' progress over time compared to a reference progress curves defined by instructors, for basic and advanced competencies.

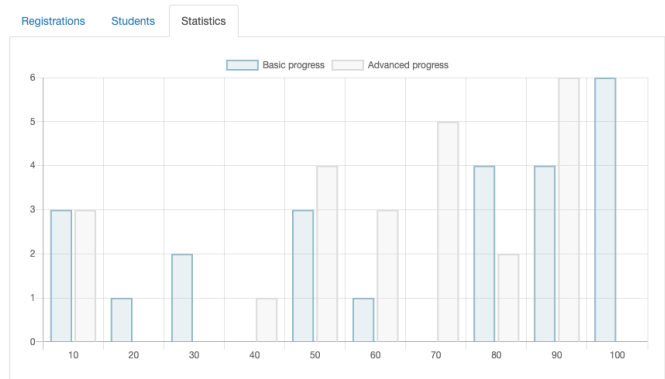


Fig. 4. Instructors can get an overview of the progress of the learners from their classroom, with the basic and advanced competencies acquisition.

progress for the four competencies of a course for a given learner, who already achieved 100% of mastery level for the basic competencies and 80% for the basic ones. Figure 3 shows the reference progress evolution recommended by instructors and the real progress made by one learner. In this particular case, the learner is in advance, always being above the reference. Finally, Figure 4 shows the classroom overview available to instructors, showing them the competencies acquisition situation of all learners at once.

Also, in addition to the features dedicated to instructors and learners, the platform can also be used by researchers and analysts to access some collected data. The analyses presented in this paper relies in particular on some of these data, collected by the backend of the TLCA platform.

IV. ANALYSES

The presented results are supported by qualitative and quantitative data collected on several runs of courses taught by different instructors from different institutions. Two sources of data have been used:

- for each evaluation presented by students, the TLCA platform collects the date of its presentation and the number of competency stars that has been acquired for each competency covered by the corresponding assessment,
- at the end of the semester or year, a survey has been conducted among students of the considered courses.

Two teaching units taught by different teachers from two institutions and targeted to different publics have been considered. Their characteristics are summarised in Table I. The first one is a computer application development course taught to second year bachelor students following a computer technology program, described in [17] and referred to as “*IT-Dev.*” It consists of one theoretical part and one development project part. Two consecutive editions of this course have been analysed. The second teaching unit is a digital transmission course taught to third year bachelor students in electronics and in telecommunications, described in [18] and referred to as “*DigTrans.*” It has been structured with micro-courses, three being focused on theoretical aspects and one being a project.

Based on all these data, two different kinds of comparisons are possible: two consecutive editions of the same course (*IT-Dev*) with different student cohorts and two different teaching units (*ITDev* and *DigTrans*) with different structures and that used the proposed approach differently.

A. Analysis #1: Basic Statistics on Evaluations

The first analysis computes basic statistics related to the number of evaluations presented by students and the number of acquired competency stars acquired. Inactive students have been removed for this analysis, that is, those with less than five evaluations or that did not show up during the final exam when there was one. Table II shows the obtained data. Comparing them for the different courses, students who succeeded always presented more evaluations than those who failed, while generally obtaining more stars per passed evaluation. This observation seems quite intuitive, in the sense that to obtain all the required competency stars, there is no miracle, students must present and succeed a minimal number of evaluations.

B. Analysis #2: Evaluations Rhythm

The second analysis that has been performed is about the rhythm of the evaluations, that is, the pace at which students presented evaluations over the semester or year. The average number of competency stars obtained by passing and failing students each week has been plotted for the *ITDev* teaching unit (top) and one micro-course of the *DigTrans* teaching unit (bottom), as shown on Figure 5.

For the *ITDev* teaching unit, passing and failing students follow an identical pattern of evaluations, with activity peaks at the same time, probably due to teacher actions (incentives, deadlines, etc.). But passing students were globally more

TABLE I
TWO TEACHING UNITS WITH DIFFERENT CHARACTERISTICS TAUGHT BY DIFFERENT TEACHERS HAVE BEEN CONSIDERED.

	IT Dev.		Dig. Trans.
	2020	2021	2020
Content	IT development	IT development	digital transmission
Institution	EPHEC	EPHEC	ITSCM
# students	80	89	28
# teachers	3	3	2
	working day	working day	saturday
Study year	2 nd bachelor	2 nd bachelor	3 rd bachelor
Span	1 st semester	1 st semester	all year long
Modalities	fully remote	fully on-site	fully remote
Structure	single course	single course	micro-courses
Activities	theory/project	theory/project	theory/project

active, earning about twice more competency stars per week than failing students. Also, succeeding students tend to present less evaluations during the exam session. An explanation is that these students did not need to present anything during the exam session as they already succeeded the course during the semester. This is more noticeable in 2020, during which teachers proposed a lot of evaluation timeslots during the end of the semester. That was interesting for active students, but overwhelming for the teaching staff.

For the *DigTrans* teaching unit, passing students had a better progression rhythm during the year than failing students, in terms of acquired competency stars. At the beginning of the year, the rhythm was similar for all students because mandatory quizzes were organised the first weeks.

This analysis highlights that students’ implication and regularity is a success factor with the proposed approach. Students who regularly present evaluations are more successful. Even though one goal of the approach is to foster students’ autonomy, deadlines and teacher sollicitations are key factors to increase students’ activity at specific moments.

C. Analyse #3: Students Survey

The third analysis is based on a survey conducted among students at the end of the semester. A first set of general questions about the approach has been asked to all the students considered for this paper. Table III shows the results of the survey for the two editions of the *ITDev* teaching unit and for the *DigTrans* teaching unit.

This analysis reveals that students globally appreciated the proposed CBA approach (A1). The autonomy that students can enjoy has been appreciated (C2) and they were actively interested in the tracking of their progress (F1). Also, students felt that the workload was higher compared to other courses of their programmes (C1) which is perhaps a consequence of the continuous evaluation aspect. A last observation that can be done is the difference between both teaching units. There are less negative opinions in the *DigTrans* course. One reasons is probably that since this teaching unit is taught at odd times and for workers, the approach suits them better.

Another interesting analysis that can be conducted from the results of the survey that has been conducted for the second edition of the IT development course is summarised

TABLE II
BASIC STATISTICS ON THE EVALUATIONS AND THE ACQUIRED COMPETENCY STARS SHOW THAT FAILING STUDENTS TEND TO PRESENT LESS EVALUATIONS WHILE ACQUIRING SIMILAR NUMBER OF COMPETENCY STARS PER EVALUATION THAN SUCCEEDING STUDENTS.

	IT Dev. (2020)			IT Dev. (2021)			Dig. Trans. Intro			Baseband Trans.			Dig. Modulation			Dig. Trans. Project		
	All	Pass	Fail	All	Pass	Fail	All	Pass	Fail	All	Pass	Fail	All	Pass	Fail	All	Pass	Fail
# students	63	30	33	44	26	18	24	17	7	24	18	6	24	19	5	24	15	9
Av. # evaluations	15.4	19.5	11.6	18.5	21.5	14.1	7.0	7.6	5.6	6.9	8.1	3.5	6.1	7.0	2.6	5.4	6.6	3.4
Av. # stars	29.4	38.4	21.3	33.6	40.3	24.1	13.3	15.0	9.3	8.3	10.0	3.3	8.3	10.0	2.0	15.0	18.0	10.1
Av. # stars per evaluation	1.9	2.0	1.8	1.9	1.9	1.8	1.9	2.0	1.7	1.2	1.3	0.9	1.3	1.4	0.7	2.9	2.8	3.0

TABLE III
THE RESULTS OF NINE STATEMENTS THAT STUDENTS HAD TO EVALUATE ON A 5-LEVEL LIKERT SCALE SHOWS THAT THEY ARE GLOBALLY SATISFIED WITH THE PROPOSED COURSE DESIGN, NO MATTER THE COURSE OR THE EDITION.

	IT Dev. (2020 and 2021)					Dig. Trans. (2020)					All students				
A1 I appreciated the competency based assessment approach.															
B1 I have the feeling that I better assimilated/understood the course material.															
B2 I have the feeling that I have had a better control over my learning.															
C1 I have the feeling that I spent more time working (during the year, the revision break and the exam session).															
C2 I appreciated being able to progress at my own pace.															
D1 I have the feeling that the evaluations made with this device are more fair, leaving less room for chance.															
D2 I appreciated being able to choose the assessments to work on to prove the competencies I needed to acquire for this course.															
E1 I have the feeling that I have been better supported in my learning.															
F1 I regularly checked my progress on the platform to find out where I was.															

in Table IV. This latter shows the relation between the “level of success” in the course, the degree of involvement and the perception about the fact that the proposed approach fostered students to work regularly. Both the involvement and the perception of being encouraged to work regularly decrease with the level of success.

V. DISCUSSIONS

Thanks to the three analyses presented in the section above, and the answers to open questions asked to students and teachers, answer elements to the two research questions can be brought and discussed.

A. RQ1: Fostering regular involvement

The first research question is about whether the proposed approach manages to foster a regular involvement of students in the course. The first answer elements can be obtained from the survey. Students feel to have worked more during the whole year and they regularly checked their own progress on the TLCA platform. It can be assumed that they tried to regularly make progress, otherwise there is no explanation to

TABLE IV
THERE IS A POSITIVE CORRELATION BETWEEN THE LEVEL OF INVOLVEMENT AND THE REGULAR WORK BASED ON QUESTIONS ASKED TO STUDENTS AND MEASURED ON A 5-LEVEL LIKERT SCALE FROM 1 (COMPLETELY AGREE/HIGH) TO 5 (COMPLETELY DISAGREE/LOW).

Have you succeeded the course?	What is your involvement level in the course?	I have the feeling that the proposed approach encouraged me to work more regularly
Yes	1.58	2.25
No, but I only miss a few stars	2.25	3
No, I only succeeded a few evaluations	3.2	4.4
No, I passed no or very few evaluations	4.5	5

their need to check their progress. However, depending on the teaching unit, it can only be to check the progress they made thanks to the mandatory assessments imposed by instructors.

The second analysis about the evaluations rhythm also brings some elements for this first research question. For all the

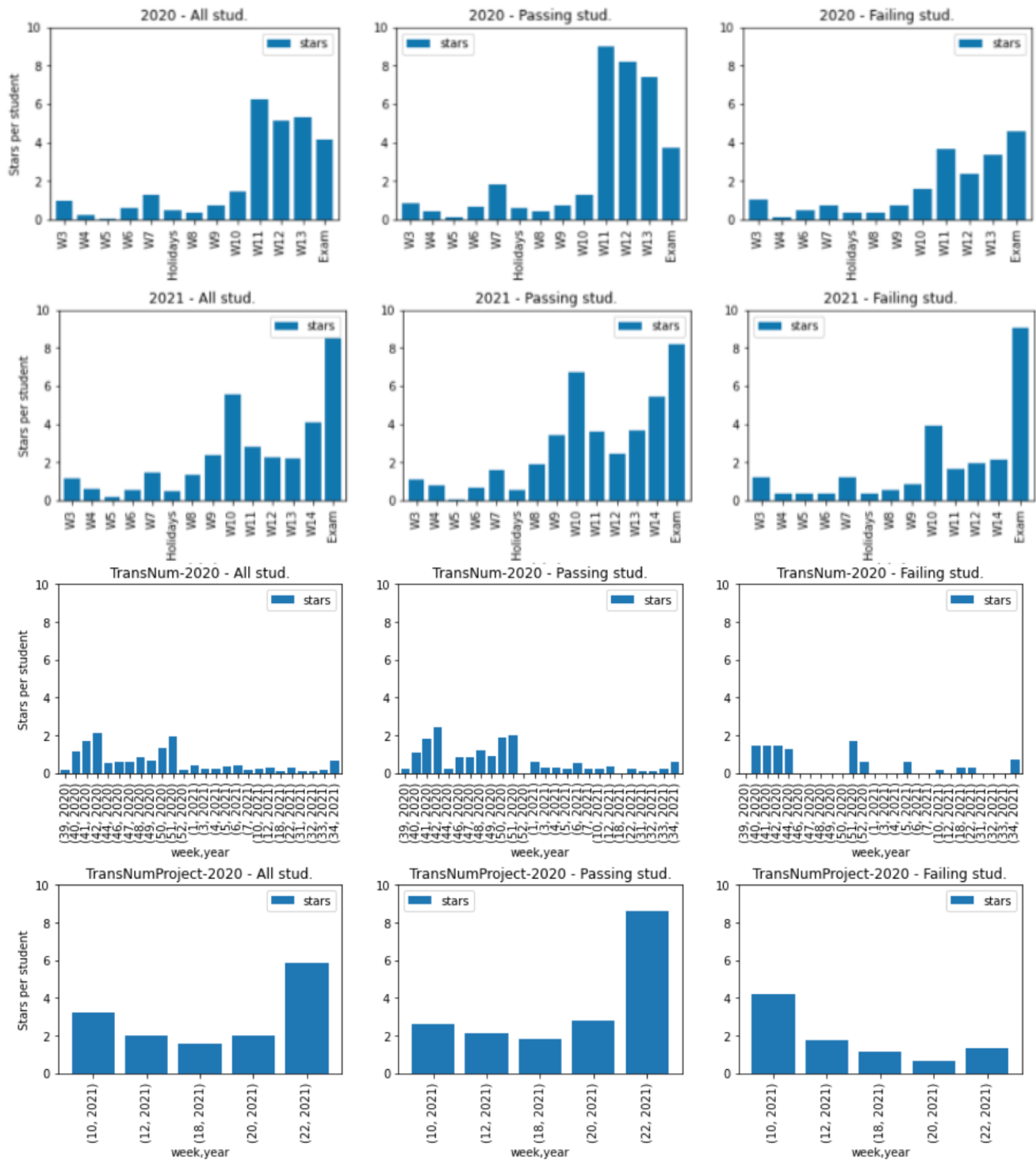


Fig. 5. The average number of competency stars obtained by passing students is generally higher over time than the same average for failing students.

analysed courses, some common effects are observed. Some peaks in evaluations are partly due to evaluations that took part at specific moments in time, chosen by teachers. A peak at the end of the semester or year is generally due to students waking up to succeed the course by presenting a few more assessments to acquire the missing competency stars.

For the *ITDev* teaching unit, most of the assessment have no deadline. However, there is a project part in this teaching unit, for which several phases have been defined, resulting in an implicit rhythm to follow. Lab sessions are indeed aligned with the phases of the project, and active students will therefore present evaluations more regularly. Comparing

the two editions of the *ITDev* teaching unit makes the regularity more visible, which is probably due to the fact that the course was more mature in this form, that there was a better communication from instructors and that intermediate informative deadlines have been fixed.

For the *DigTrans* course, the difference of regularity between succeeding and failing students is much more visible and there is no end of year rush effect. This is probably due to the fact that students incrementally made progress all over the year, micro-course by micro-course.

The proposed pedagogical device wants to encourage regular work. In any case, students should work regularly to succeed because it is nearly impossible to present all the evaluations only at the end of the year or semester. This fit with the intuition that acquiring competencies take time.

The observations that are made with the collected data about the evaluations rhythm show a better regularity for passing students. It is more or less marked depending on the teaching unit and its audience. Also, the survey indicates that students are interested to regularly know their progress level. Therefore, these elements show that the regular involvement is mainly only observed on passing students than on failing ones.

B. RQ2: Impact of regular involvement on success

The second research question is about whether a regular involvement with the proposed approach impacts students' success. From the first analysis, it is clear that students must present a certain number of evaluations to succeed. Of course, in absolute terms, it would be possible for students to present all the evaluations at once. But this is logistically impossible for teachers to sustain an evaluations peak at the end of the year. It would also be out of step with the proposed approach.

The second analysis tends to show a difference of pattern between passing and failing students for both teaching units. Evaluations are better spread all over the course period for passing students and the "peak effect" is a little less accentuated for failing ones. However, these observation cannot lead to the conclusion that regular involvement implies success, but rather than succeeding students worked more regularly than failing ones.

Nonetheless, the results presented on Table IV show that students who succeeded have a better feeling that the proposed approach encouraged them to work more regularly. They were also more involved in the course. From these data, it is possible to conclude that students who were encouraged to work more regularly, and hopefully did, were driven towards success.

C. Threats to Validity

The results presented in this paper are quite encouraging though the conclusions are not strong. The proposed continuous CBA approach has been designed to provide some level of autonomy to students and, at the same time, to encourage them working regularly. The analysed courses being kind of isolated in students' programmes, there is a risk that students use the provided autonomy to delay all the work at the end of the semester, as observed by the end of course period

evaluations peaks. This means that the observed results may be partly a consequence of students' behaviours that are not only driven by the proposed approach by itself but within their broader educational context. To be more conclusive, the research questions and analyses must be refined.

VI. CONCLUSION

To conclude, this paper proposes a pragmatic competency-based assessment approach to replace marks by competencies acquisition levels to evaluate learners. It also analyses data collected by the supporting platform about students' evaluation rhythm for two different teaching units that used the proposed approach. These analyses show that even if the pedagogical device aims at fostering regular involvement, it only managed to do so lightly for the two considered teaching units. However, the collected data clearly indicate that a regular involvement with the proposed approach is a factor of success.

To address these observations and improve the proposed approach, means to encourage students to be proactive have to be integrated. Several ideas for future development have been imagined, both for the proposed approach and the TLCA platform. First, instructors should be able to propose a progress guideline and learners should be able to see where they are according to it. Also, soft or hard deadlines should be put for every assessment, to discourage learners to postpone their work. The right balance between autonomy and deadlines should be carefully chosen. Indicators for instructors may be computed by the platform to help them identify early potentially struggling learners. Finally, another future development is the integration of automatically graded formative assessments. They will allow learners to assess themselves before making an appointment with instructors, to check if they are ready enough. In particular, automated code assessment tools developed in previous works will be integrated [31], [32].

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