Critical Exploration of Flexible Delivery

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***Abstract*—This work-in-progress research article presents an introductory qualitative study on students' perceptions of a flexibly delivered, modular computer science course. Many contemporary approaches to education rely in various ways on flexible delivery of course content. This is often done to capitalize on modern technology and the web, and to put the student 'in the center.' However, it is becoming manifest that these approaches may challenge both the students and the equity between them, making it important to understand the effects of flexible delivery in terms of the students. In the voice of our students, flexible delivery was seen as a largely positive approach, reducing stress, promoting true learning, and allowing students to better manage their workloads. We also see the effect of the learning environment (teacher, LMS, materials, activities) on a flexible course. Although this qualitative study cannot foreground the extent of typical self-regulation challenges with flexibility, we argue that the observations made precipitate discussion on flexible delivery in curriculum planning from the students' perspective.**

I. Introduction

Online, blended, and flipped learning scenarios are typical in academia. Arguments for flexible courses include monetary gains and accessibility across different study situations [1]. Opposite arguments show worries on learning itself, that is, how to nurture the thought processes of individual students [2] [3]. This Work in Progress research was commenced to investigate students' experiences of a flexible study condition in detail. The study was motivated by our observation of many students delaying their course work in such a setting. The target course was a first-year Computer Networks (5 ECTS credits) at University of Jyväskylä (Finland). This course is studied in a self-paced manner and without deadlines, and can be taken in different sizes (from 1–5 credits).

An email survey asking students' opinion and experiences of flexibility was issued to four course cohorts. For this preliminary work, we thematized N = 46 qualitative responses. The themes identified revealed a multitude of advantages of flexibility from the students' perspective, while also including the typical self-regulation challenge stated in the literature (e.g. [4]). We believe that the advantages, in particular, precipitate discussion on the role of flexibility in curricula.

II. Related work

Flexible delivery can be seen as an educational sectors' response to information age [5], which both enables new ways of delivery and proselytizes rapidly changing social contexts and emphasizes life-long learning. Flexible delivery is generally understood as series of actions taken to increase flexibility in learning [6]. The goals include adoption of student-centric perspective, unification of on- and off-campus students and providing students more authority on how and when they study [1]. From the teacher's perspective, flexible delivery relates to providing a combination of different teaching methods, such as lectures, labs, online content, and video-conferencing [1], relating it to the concept of blended learning [7]. One tool for enabling flexibility is modularization, or partitioning courses into "self-contained, independent units of a planned series of learning activities" [8]. A modular course structure has many potential benefits, such as having frequent assessment opportunities [8], allowing students to easily review or repeat earlier modules [9], and self-paced studying [8].

Although the student-centric perspective is often foregrounded, flexible delivery is often adopted for economic reasons or desire to appear as a forward thinking institution [1] [10]. The adoption is also driven by the progress of technology [10]; many pedagogical innovations are naturally online and can be delivered remotely at no perceived additional cost. However, adopting flexible delivery and student-centric view is not without difficulties. By adopting student- and learning-centric view teaching comes to rely more on skills of the students. Firstly, to engage optimally, or even sufficiently, with a variety of learning situations, students must possess a good degree of information literacy [5]. For example, highly modular courses enable students to focus on their interests and weaknesses, but such a focus necessarily demands skill to strategize on part of the student; a demand that is not present in non-modular courses. Secondly, the students must be mature enough to perform in situations that call for self-regulation and -direction. For example, self-pacing requires students to set, and to keep, their own deadlines. However, people in general often set their schedules in a non-optimal way [11]. Moreover, it is claimed that nearly half of academic students suffer from procrastination [12], a tendency that is compounded by lack of deadlines, or a final deadline looming in far in the future [11]. Asynchronous online delivery, commonly employed to enable flexible delivery, can further compound upon students tendency to procrastinate [13]–[15]. Difficulties in decision making, delaying and incomplete projects, and perfectionism, are known signs of procrastination [16].

Studies reporting observations that apparently relate to the

self-regulation challenge and procrastination in flexible setting are [4] [17]. Redondo [18] reported on a course in which students could select differently rated exercises and added a gamification element to this scenario. The authors do not report the self-regulation challenge, with the potential reason being that elements such as gamification might mitigate it. In a recent study on study difficulties, CS students reported having difficulties with getting started, being readily interrupted, and falling behind [19], which all chime with the self-regulation challenge and procrastination.

Yet another concern is equity related to students' preparedness for online learning. In a Study by Xu and Jaggars [20], all students suffered from online courses while some groups suffered more than others: males, younger students, black students, and students with lower GPAs. These authors suggest online learning to be implemented as a privilege rather than a right; here, sufficient preparedness would be ensured on the part of learners before granting them access to online learning. Guzdial [21] discussed this topic in CS education, noting that on-line delivery can be problematic for many students, such as those who are economically disadvantaged. Regardless of inherent challenges, the progress of technology and contemporary events [22] strongly favor adoption of Flexible Delivery techniques and, as already observed by authors two decades ago [1], [23], what is now discussed under the term Flexible Delivery will likely integrate to the notion of common practice of teaching in the future. This, however, calls for recognition and study of different models of flexible delivery.

III. The study

A. The target course

As for students' background, flexibility is not (to our best knowledge) used in the present extent in conventional high schools. The degree of flexibility during the first-year CS studies depends on how teachers choose to implement their courses. First-year CS courses do combine possibilities for distance learning and classroom presence, and provide videoed lectures. However, the present target course represents a more substantive take on flexibility; indicated by our data. Locally, many CS students are delayed in their studies compared to an expected 5-year (bachelor and master degrees) pace. This observation has excited discussion on the degree of flexibility that should be provided and the students' preparedness for self-regulative learning at the beginning of studies, and motivates the present qualitative study on the students' perspective.

The target course was a first-year 5-credit course on Computer Networks. The course is modularized in five parts each worth 1 credit. These five parts can be completed independently and there is no deadline for the course or its parts. The course is mandatory at size 5 credits for Computer Science majors and at size 3 credits for Computer Science minors. Three first credits of the course are completed with exams. When the course is lectured in the spring there are five lectures followed by a midterm exam for the first credit, and similarly for the second and third credit. The students can retake the exams, e.g. at the second midterm, they can try to improve the results of the first midterm in addition to taking the second midterm. After the course, there are also final exams, where the students can choose to do any, or all, of the midterm exams. There is also a possibility to take any of the midterms as an e-exam, throughout the year.

Lectures are recorded and the videos of the lectures are available in addition to course materials. There are also some practical tasks for the first three parts, which can be used to gather extra points. The last 2 credits are done completely with practical exercises, including, e.g., network analyzing and programming. The maximum points for each part of the course is the same. The relation of points from exams and exercises to the grade, and the cumulatively increasing extent of the course, are presented in Table I.

TABLE I
Relation of points to the grade and credits.

Grade \ Credit	1	2	3	4	5
5	30	60	90	120	150
4	26	52	78	104	130
3	22	44	66	88	110
2	18	36	54	72	90
1	16	32	48	64	80

The students can choose to take an accomplishment at any time with any credit and grade. They can continue the course, even years later, to improve their grade or extend the credits to what is required for them. The points that the students have gathered are thus not lost and the student can continue their studies from where they had left. Often the case is that the student completes three first credits with lectures and exams and leaves the practical credit completion to later time.

With the practical exercises, the students have some freedom to accomplish the course in different grades. For example, if they want to just pass the course, they can gather enough points to get the minimum amount of points required to pass the course with a grade of 1. They still have the opportunity to improve the grade before they graduate. Graduation is in practice the only deadline for the course.

B. The email survey

Four course cohorts (years 2015 – 2018) were reached out through email. The email questionnaire consisted of the questions below (our translation to English).

- How long did you study to complete the course? (the respondent selected a category; see Table II)
- What is your opinion of the possibility to study the course flexibly in small portions without deadlines? (open-ended question)
- How the flexible measures of the course influenced your studying? (open-ended question)

During this round of data collection, N=46 responses were received and deemed sufficient for a preliminary qualitative study. A data-driven thematic analysis [24] was conducted to identify different perspectives in the students' responses to flexibility. The approach of this work-in-progress study is qualitative; quantitative conclusions are not warranted.

IV. Preliminary results

A. Descriptive results

Table II presents the percentage of students who started the course in relation to how long it took for them to complete it. For example, of all students who started, about 26 % completed the course within two months. Starting indicates a student gathering more than zero points from the course. (The amount of students who registered but never started was about 33 % of all the registered students.) Table also presents the percentage of survey respondents categorized by the completion time. Some categories are underrepresented in the answers, e.g., those students who never passed the course seem also to neglect the survey about the course. The 12+ category mostly consists of students who have completed the course years after starting, when the deadline of graduation forced them to complete the course. Those students might be more willing to answer to the survey as the completion has happened recently. Even though about 70 % of the answers came from students who completed the course in six months or less, there are answers from all categories. Moreover, some respondents in the two-months category did not complete the course when it was lectured but delayed it and then focused on it for a few weeks.

TABLE II
Students who started in relation to completion time

Time to complete [months]	Students	Answered to Survey
0 - 2	25,74 %	39,13 %
2 - 6	33,29 %	32,61 %
6 - 12	8,82 %	4,35 %
12 +	8,89 %	15,22 %
Never	23,27 %	8,70 %

B. Students' responses to flexibility

The student responses to flexibility, in effect, praised the course setting provided. Only one response out of 46 identified a self-regulation challenge without any, otherwise positive attitude toward or personal experience of flexibility—the respondent belonged to the category of 'Never' completed (see Table II). One other respondent suggested that a final deadline such as one year could be helpful. Moreover, one response underlines how critical it was to have the flexibility available, noting that this was the course that was possible to study while other (less flexible) courses had caused the respondent to quit studying altogether. A few neutral responses indicated 'no effect' because of a personal intention to complete the course within a period (which was realized). Below, we report with illustrations the multitude of perspectives identified as students' responses to flexibility. We begin with learning-related perspectives and then proceed to studying-related perspectives. The last category of perspectives highlights the features of the study environment that contributed to positive experiences.

1) Learning-related:

(a) Motivation and incentive for good learning
I liked that I could take the responsibility for the intended credits and grade. This setting provided an incentive to learn as much as possible and complete as many course exercises as possible.

(b) Concentration; self-selected time for good learning
Without the deadline, I was delayed from the weekly rhythm, as there was no burning hurry. As soon as the other courses of the period were in good shape, I concentrated on this course, and studied the 3-credit contents during May with good grades. I think I am a learner for whom separated studying, focusing on one topic at a time, suits best, so I was able to arrange my studying accordingly.

(c) Related to the previous, learning over cramming
It [the flexibility] *had effect on what was internalized, there was no need to quickly cram the contents but instead* [there was] *time to ponder on what you were learning.*

(d) Related to the previous, better result becomes possible
The best way to study. The outcome would have been worse without the opportunity for flexible study. Another student: *Without the flexible setting, I might have been able to push the course during a period, but potentially with a worse grade and feeling miserable.*

(e) General competence can be increased in between modules; helps learning
[...] *It also good that you can increase your competences with the help of other courses in between, and then continue to take the other parts.*

(f) Recap needed, when time passes between the modules
This quotation simultaneously illustrates studying-related items (e) (j) and (k): *Learning from distance and alongside work, I found it a big benefit that I could study flexibly without time limits. On the other hand, it happened that I completed only one credit when the course was actually arranged, and the rest after little over a year, when I needed to recap and the course was kind of hanging. Regardless, I feel that the opportunity for flexible study was excellent.*

(g) Formative-assessment effect
[...] *Also dividing the course into small pieces created clear milestones and helped in completing the course, because when some part of the course was completed you knew based on the exam what was your level at that point.*

Of these, the concentration that became available (see in particular items (b)-(d)) was a frequently stated learning-related perspective that was valued if not praised by the respondents. A favorable comparison was made to studying multiple parallel courses with fixed deadlines, a condition which was noted to force instrumentalist studying.

2) Studying-related:

(a) Goals not adhered to; challenge with self-discipline
In my case, I lost my grasp of course work because there was no external pressure to take on it.

(b) Not aware of supervision; challenge with independence
It would have been a good idea to attend the supervision sessions when working on the network traffic assignment, because it was very laborious and difficult to do alone. I did not realize that I could have attended after my decision to take the course independently.

(c) Autonomy can be challenging as for motivating one-self
[...] *In self-directed study, it is occasionally difficult to motivate one-self, but I am yet of the opinion that it is a good way to study.*

(d) Autonomy valued; good to learn to manage
Taking a course in small portions versus a final exam [convention] *is*

not the critical question. Rather, I would like to stress the importance of supporting toward independent studying.

(e) Delayed but appreciating flexibility, illustrated above

(f) Reward in steps, according to the effort
[...] *Taking the course in small parts, so that you were nevertheless rewarded for those parts, felt supportive and useful.*

(g) Planning and management of workload made possible
I could progress with the materials and exercises according to my own pace, when this fitted in my schedules. I got the positive feeling of this and learned a lot. Another student: *With the help of this course, workload could be balanced. (When the other courses had a light workload, this one could be advanced, and when the other courses were loading, this one could be delayed.)*

(h) Reduction of stress
Personally this [the flexible setting] *reduced stress considerably although it did not* [otherwise] *affect my studying much [...] Another student:* I think that because there was not that pressure regarding schedules *[cf. stress] the learning results was better.*

(i) This way of study not often provided/possible
This is constantly illustrated in how students compare the course to other studies. One student put that, due to not being able to study according to one's own pace, *I have quit a very high number of courses or just reached the grade 1.* [lowest grade]

(j) Suitable across varying life situations, illustrated above

(k) Related to previous, critical need for distance-learning supported, illustrated above

(l) Identified as more effective (and rapid) way of study
[...] *Flexibility allows you to see small topics through larger units. Then, single exercises are easier to see as part of a whole that has been absorbed before taking on the exercises. Learning is then rapid.* [...] Students also valued the possibility to complete the course quickly—kind of a fast track.

(m) Space for studying other (typically less flexible) courses
I think the flexibility in this course helped my first spring. I took all the recommended courses and it was too much at first. I felt I need to choose the contents (courses) I really want to learn, and the courses in which I rather attempt to optimize learning for the exam and afterwards forget the most of it. [...]

(n) Required by the discipline
It [the flexibility] *is important in studying ICT. Some topic must be studied for a longer time, some other topic can be managed faster.*

Possibility to personally manage studying and workload is the major positive effect for the students. Many students highlighted that this reduces stress; there is less pressure that typically arises from parallel deadlines, and other courses can be better coped with. Constant comparison to other studies indicates that flexibility in this extend is not typically available.

3) Well-working environment:

(a) Committed teacher
The course and its implementation was just brilliant. The implementation reflected the [teacher's] commitment to teaching. In other of his courses, you also have very flexible opportunities to make progress. [...] Moreover, the plurality of study options, the flexibility with schedules, and the teacher's quick response time as for evaluations enable an appropriate manner of progress for most of the students.

(b) well-designed exercises, suitable for flexible study

(c) Good learning materials

(d) Good use of the platform (LMS).
This quotation illustrates the items (b)–(d): *I think I worked hard and applied myself to the topics. The reason was that, in addition to scheduling, the course as a whole was well arranged. TIM* [an LMS] *platform was used effectively for theory learning and exercises were clear. I argue that flexible schedule exactly requires such arrangements, in which lectures can we watched according to personal pace and exercises done according to personal preferences, with sufficient instructions provided for both of these.*

Students thus valued the course arrangements in conjunction with being satisfied with the flexibility provided. This simply calls attention to accessibility of the learning environment when flexibility is provided.

V. Discussion

This work-in-progress paper investigated students' standpoints to flexible delivery in the context of a first-year computing course. The self-regulation challenge, conforming to the previous research (e.g., [4] [17]), was identified. On the other hand, students also appreciated the possibility for a rapid completion (cf. fast track), which could be seen to match the typical organization-level wishes regarding flexible delivery and monetary gains (see [1]). Altogether students' evaluations were positive if not praising across the respondents.

Issues discussed less in the literature are found in the students' detailed positive evaluations. Studying the flexible course at several and/or self-selected occasions without deadlines was noted to allow concentration on learning in place of instrumentalism. In sum, the students identify less stressful true learning as they self-select time windows for their studying, and frequently refer to a supportive and motivating setting. This echoes internal motivation from autonomy [25] but also that students appreciate the attention to their daily challenge with parallel courses. In one sense, one might expect 'fast-track instrumentalism' out of a highly modularized offering but the students emphasized the opposite.

Another critical point is the relationship between flexible and non-flexible courses, which was constantly, either explicitly or implicitly, referred to. The students' responses unavoidably signal that teachers, by setting their course instructions, are competing with each other for students' attention and resources. The research should carefully examine the cost of 'flexible versus non-flexible' from the perspective of learning.

While we anticipate that challenges with self-regulation and independence would be more substantively and vividly stated in a larger sample, we are also inclined to conclude that flexible courses, tailored into accessible environments, could provide a measure for building student autonomy. This calls attention to small modules that contribute to mastery experiences and thereby support autonomy and self-belief—Such attempts should not occur without attention to critical attributes affecting study motivation, such as belongingness [26].

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