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Project Report

A proposal for student-centred first year teaching

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Executive summary

We present a new proposal for teaching at first year university level that better adjusts to the individual strengths and weaknesses of students as they enter university. We suggest that changes in teaching approaches and student support are urgently required to facilitate successful outcomes that serve individuals, institutions and society well. Students come from diverse backgrounds, many study part-time and have additional responsibilities beyond their studies. Students invest their time and money and may accumulate large financial debts for their years of study. Failure rates are substantial and even students who pass often do not build the strong foundations in subject knowledge and study skills required for successful degree completion. The pressure on students to achieve affects not only the students but also higher education institutions and teaching staff, as pass rates determine funding.

Our proposal builds on a large body of literature and strong evidence of effectiveness of the Personalised System of Instruction (PSI) that was popular more than 50 years ago. Combining this with Self-Determination Theory (SDT) and our experience of effective educational practice we provide an outline for how such a proposal might be implemented. Through paying close attention to the design of the learning environment and following the principles of SDT, our proposal advocates explicitly supporting the development of autonomy, competence and relatedness in our students and thus aims to increase both student motivation to succeed and student success.

Fundamentally, our proposal is about substantially increasing the opportunity for meaningful pedagogic conversations between students and teachers. How fast and how well a student progresses through the course will be determined not by administrative constraints but by the student themselves. Students at all levels of subject knowledge and learning skills at the start of the course should have a strong chance to pass the course and do so well. Through direct engagement with students, the teaching team can adapt and focus their formative feedback to meet individual student needs as well as inform course design.

In effect, we present a way to transform the conventional course from a static set of resources, lectures and activities programmed for administrative convenience to a living, breathing and continually evolving process. Important elements include: flexible semester durations based on individual student needs; opportunity to learn from formative feedback to ensure students cover all learning objectives; mandated, focussed, one-to-one discussions with teachers; scheduled opportunities for student-led problem-solving and discussion; study plans developed by students to match their own circumstances and knowledge; and a well-structured and responsive support network. We ask students to take responsibility for their learning.

Through a series of in-depth, semi-structured interviews, higher education teachers and learning and writing consultants have provided feedback on our proposal. Their feedback echoes the literature reviewed and we have documented their endorsements, cautions and insights with respect to potential implementation. Our interviewees see the potential for assisting students based on their individual needs and for ensuring that students move on with solid knowledge foundations and study skills. What came across strongly is the passion educators have for helping students and the satisfaction they gain from direct contact with students.

It is central to our proposal to significantly increase the number of hours invested into student support. The number of casual support hours per student in first year courses in the mathematical and information sciences sits currently at about 1.5 hours per student and

semester, lacking well beyond what is offered in other disciplines. We argue that this needs to be lifted substantially to about 8 hours to ensure that students pass first year courses with strong levels of subject knowledge and learning skills. We propose that the additional support would result in substantially higher pass rates and improved retention at higher levels of study, paying back the initial outlay.

From the evidence presented in this report, our clear recommendation is that our proposed approach is piloted within one or two institutions with a limited number of courses in order to i) properly determine the costs of implementation and ii) evaluate the degree to which anticipated benefits accrue.

Appended to this report we include brief thoughts with regard to administration implications of our proposal (Appendix B) and tools and setup requirements (Appendix C).

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1 Introduction

Our proposal focuses on first year courses at university. First year has a special importance as the entry level into university studies, with the need to develop foundational subject knowledge and learning skills. First year also marks important personal transitions and challenges, in moving from attending school to learning and living as an independent adult and in juggling study with family and work commitments. A rich body of literature examines the challenges and state of first year in higher education.

Kift (2015) reviewed ten years of research into transition pedagogy, a framework designed to address the challenges of transition into university study by focusing on curriculum design, scaffolding and support for today's heterogenous student cohorts in the contexts of limited resourcing, changing environments and diversity. Kift (2015) emphasizes the importance of successful transitions into university study for the students directly affected, but also on society, professional and economic levels. Baik, Naylor & Arkoudis (2015) researched first year experiences at Australian universities over two decades. The authors found strong improvements over this timeframe, yet also noted that a significant proportion of students struggle with their motivation to study and have difficulty in coping at university. Nelson (2014) summarizes the achievements in first year in higher education based around integrated and engaging curricula and collaboration across academics and specialist educators. Yet, she also points to the challenges remaining, such as providing equal opportunities and reducing attrition.

The recommendations on how to move forward contain strong messages. The curriculum needs to be at the centre (Kift, 2015; Nelson, 2014). Life and learning support needs to be integrated with the curriculum (Nelson, 2014). Support should be provided proactively, when it is needed, tailored to individual student needs, fostering a sense of belonging (Kift, 2015). Supportive learning environments are essential (Kahu, Stephens, Leach & Zepke, 2013). It is important to raise students' confidence and assist them in learning how to seek help (Nelson, 2014). Students need to be challenged with learning experiences that enrich and extend (Zepke & Leach, 2010). It is important to foster interaction with peers and teaching staff (Baik, Naylor & Arkoudis, 2015; Kahu et al., 2013). Academic and professional staff should work together (Kift, 2015).

As underlined by the literature cited, the support for the transition into first year university study is extremely important and recommendations have been made. Yet, implementation of recommendations is complex and arguably not reflected in first-year realities. For example, the importance of tailoring support to individual needs is well recognised but with large and diverse cohorts, how do institutions achieve this in practice?

We propose an approach to student-centred first year teaching that goes back to the Keller Plan or Personalised System of Instruction (PSI; Keller, 1968), a system with proven evidence of improvement in student learning outcomes (Kulik, Kulik and Carmichael, 1974; Taveggia, 1976). For a range of reasons, such as narrow perceptions of university teaching, resource requirements and student procrastination, which we discuss in the literature review, PSI approaches fell out of favour in the 1980s. We suggest that it is time to revisit the ideas of PSI as some of its implementation challenges may be more readily addressed today, in particular because of advances in information and communication technologies. To frame our approach, we draw on modern learning theories, in particular the framework of self-determination theory (SDT; Ryan and Deci, 2002). We argue that PSI and SDT, supported by modern technologies, provide a strong basis for a flexible system of learning and teaching designed to fit the needs of contemporary society and 21st century learners.

Our focus is primarily on science and numerical disciplines, based on our teaching experience in those areas. Our approach might also be suited to the humanities and social sciences, but this is yet to be investigated. Our specific context is university first year in New Zealand and we address both distance and on-campus modes of teaching.

Goals of our work are to prepare a new way of teaching at first year university that better adjusts to the individual strengths and weaknesses of students as they enter university than is currently the case. We want more students to pass with better subject knowledge, with better learning skills and feeling better about university study. We want to give students a fair chance to achieve, regardless of their backgrounds. We also want a system that acknowledges strengths and allows those students to proceed towards advanced courses faster than is currently possible.

Biesta (2013) thoughtfully points out, that "the gift of teaching … depends on the fragile interplay between the teacher and the student" (p. 42). What we are proposing has as its focus supporting the crucial relationship between student and teacher. Our proposal requires substantial change. The change will affect how students study, how staff prepare, teach and support courses, what financial resources are required, what learning technologies are used, and how the course administration is handled. This report describes our investigations into the desirability, and to some extent, the feasibility of implementing such an approach. It builds on research literature, interviews with university staff, a consultancy report, our own experiences with teaching and supporting students and courses, and many years of involvement with teaching and learning and research in higher education.

2 Literature

To form the theoretical foundation for our suggestions we will look back 50 years to the Personalized System of Instruction (PSI). We then examine self-determination theory (SDT) before drawing on elements from both theories to develop and justify our flexible approach.

2.1 The Keller Plan or Personalized System of Instruction (PSI)

The Keller Plan or Personalized System of Instruction (PSI; Keller, 1968) gained widespread popularity in the 1970s in school and university settings, applied often but not only in science and mathematics (Green, 1971; Boud, Bridge, Maas & Stace, 1975). With PSI the study material is not presented in lectures but provided as carefully crafted written material divided into modules. Students work through this material at their own pace in self-study and take up unit tests, when they judge themselves to be ready (the tests are available at regular intervals). Immediately after completion, a test is marked by a teaching assistant in the presence of the student. This marking includes a conversation about answers the student has provided. On achieving a minimum of 90% the student can move on to the next study module. Failing this, the student revises the material, in self-study and by attending optional tutorials, and sits an equivalent test at a later point in time. A certain number of credits are given for each test achieved, without punishment for repeat-efforts. The test credits accumulate and are added to the marks received in a final exam to determine a grade. Keller (1968) highlighted important features of PSI as follows:

- Students progress through a course at their own speed, based on their ability and time invested into study;
- Students can only proceed to new material after having demonstrated mastery of the prior material;
- Lectures are provided for motivational purposes and are not essential for the uptake of knowledge;
- The study material is carefully prepared and available in written format;
- Assistants are employed who oversee repeated testing; they score tests immediately and discuss results with the students individually; this personal communication enhances the educational process.

An example of a PSI course

Sherman (1992) estimates that over 2000 research articles examining PSI-based teaching have been published. We follow one of those articles to illustrate a PSI course in more detail.

Brook and Thomson (1982) describe teaching a large first year introductory statistics course to about 750 students using PSI. The authors focus on practical aspects of teaching the course over a period of about six years. The authors describe their student cohorts as having "widely varying quantitative abilities and backgrounds" (p. 135). Many of the students lack motivation to study statistics, which can be traced back to the course being compulsory for about one third of the students who do not intend to major in the subject. The course runs over a full academic year of 24 weeks and is divided into units of about two weeks work each. A unit is comparable to four lectures and an assignment in a conventional course. Students are provided with a study guide and a sample test for each unit. There is also additional material, such as worked examples and an assignment specification for the application of statistical methods to real data. The sample test showcases what students can expect when sitting the mastery test for a unit.

Several testing sessions are provided each week and students choose when to attend. There is no time limit, but students typically require 30 minutes to complete the 20 question tests. On completion, a proctor, usually a student majoring in statistics in their second or third year, marks the test in front of the student. The proctor discusses answers with the student to uncover and clarify any misunderstandings. A mark of at least 90% means that mastery is achieved and the student can move on. Failing this, the student will sit a different test on the same material at a later time. Several tutorials are provided each week where students receive individual attention from a staff member. Lectures are not held, as by design students are focusing at varying points in the course material at any time. About 80 hours of student proctor time per week plus substantial input from two lecturers and some assistance from colleagues are required to run the course for the 750 students. Of the 100 marks available for the course (11*5 for unit tests, 5 for a project, 15 for a mid-term exam and 25 for the final exam) students require at least 50 marks to pass.

After describing the courses features, Brook and Thomson (1982) discuss the challenges in running a PSI course for 750 students. After initially starting with just four versions of a test, a system with permutations of different test pages was used that provides 1250 different tests for each unit. Combined, the students sit about 600 tests per week. The room available allows 50 students to work on their tests in parallel. The test room should provide a quiet environment, but there also has to be room for marking conversations between students and proctors, of which usually seven are on duty at any one time. Students are assigned to proctors on a random basis to avoid the potential danger of selecting 'easy' proctors. The availability of good student proctors is essential for the success of the PSI course. Proctors are selected based on academic performance and pay rates are high enough to entice and keep the best students. Proctors are part of the teaching team. Staff ensure that working conditions are pleasant, that proctors are aware of the importance they have being in direct contact with students, and that proctors are encouraged to provide feedback to staff. Staff perform cross-checks on the marking performed by the proctors to ensure consistency. While the logistics are challenging, Brook and Thomson describe a well-functioning course operation.

There are pressures on the testing setup due to students leaving work until late in a term and various approaches were explored to enforce more uniform workloads. The system settled on from 1979 onwards involves setting deadlines for test completions. Tests completed after those deadlines receive only reduced marks (one mark less per week of delay). Brook and Thomson (1982) acknowledge that this penalty system is against the spirit of PSI but found the system effective and accepted by students as reasonable. Record keeping is assisted by a computer card filing system.

Brook and Thomson (1982) conclude that the PSI course continues to be received positively by students and staff. They are aware that their pacing strategies are contentious, yet regard those as necessary when working in a context where courses have to be completed within an academic year.

Evaluation of PSI teaching

Keller (1968) provides data showing that final results for students studying under the PSI method compare favourably with those studying under conventional lecture-based methods. Numerous studies, many of which were conducted with control groups, have since emphasised the positive effects of PSI. Kulik, Kulik and Carmichael (1974) prepared an extensive review of results and concluded the following: Final examination performance using PSI instruction is never lower but usually better than with other forms of teaching; students consistently rate studying in PSI format higher than in lecture-based courses; in most

cases students self-report having learned more, as well as having invested more time and effort into their learning.

Taveggia (1976) reviewed studies that had used experimental methods to compare PSI with conventional courses using other forms such as lecture, lecture-discussion, and group discussions. He concluded that PSI is superior. As other authors (Grant and Spencer, 2003; Sherman, 1992; Holmberg, 1982, Eyre, 2007) write, this conclusion by Taveggia carries considerable weight as this researcher had, in prior extensive research on teaching methods, concluded that no teaching method has superiority. After studying PSI, Taveggia (1976) stated that PSI has shown that how material is presented and how often students are assessed are important factors for student learning. In 1991 Buskist, Cush and DeGrandpre revisited the major research reviews on PSI and concluded firmly that PSI is superior to traditional methods. While challenges with the PSI approach exist and will be discussed shortly, our own literature review conducted in early 2018 has not identified any evidence that would contradict the strengths of the PSI approach.

Strengths factors of PSI

Going back to Keller's work (1968), five factors are at the core of PSI: self-pacing; mastery; lectures for motivational purposes; written, carefully crafted material; direct, individual interaction between students and tutors. All factors inter-relate and cannot easily be seen in isolation. Self-pacing, mastery and direct interactions are consistently named as the most important factors that need to combine to provide a strong PSI course. The importance of high-quality, carefully crafted material seems to speak for itself. The emphasis on 'written' material, carefully structured into units of study, needs to be seen in context with the teaching approaches prevalent at the time – the professor lecturing by talking 'at' the students at high speed while at the same time filling blackboards with notes. Criticisms of the typical lecture in its effectiveness for supporting student learning are common (for example, see Sherman, 1992). In PSI, lectures are therefore not meant as a primary mechanism to deliver course material, but to provide motivational highlights. The positive potential of a well delivered exciting lecture is not questioned, but the research on PSI does not see lectures as essential for the success of PSI as the other factors.

Within the context of self-pacing, mastery and direct interactions, researchers set varying emphasis. Kulik and colleagues (1974) highlight self-pacing and the direct, individual interaction between students and tutors as the features of PSI most valued by students. Taveggia (1976) emphasises the importance of mastery, implying that students can only advance to new material when they can demonstrate 'unit perfection'. This necessitates having the freedom to move at one's own pace instead of being pushed by an external time schedule. Taveggia (1976) also highlights the direct contact of students with tutors throughout their studies. This means that extra help and encouragement can be provided in a timely fashion. Besides mastery requirements and immediate feedback on test performances, Buskist and colleagues (1991) highlight the importance of review units. Those units assist students with further study on the material, should their test results indicate that mastery has not yet been reached.

Sherman, a co-author of Keller and strong proponent of PSI, writes:

> "My view has always been that instruction must provide for (a) presentation, (b) performance, and (c) consequences, each constantly adjusted to meet the needs of every individual student." (Sherman, 1992, p. 59)

PSI fits with this view on instruction, looking at the presentation of high-quality material by the teaching team, the need for students to show their understanding of the material and the

consequences in having to further revise if the performance is not at the required standard. Overlaying all of this is the adjustment to individual needs, in progress through the material and in the individual support each student receives from members of the teaching team. Grant and Spencer highlight the self-pacing, the mastery approach and catering for individual differences among students in their discussions of PSI (Grant & Spencer, 2003, p. 2):

> "Unlike the lock-step model of traditional instruction, a self-paced model recognizes and accounts for differences among students in the rate at which they learn the course material and avoids grade penalties for students who require more time to learn."

Challenges with PSI

The two serious challenges discussed in the context of PSI are dropout rates and procrastination. In their comprehensive review of PSI courses Kulik et al. (1974) found reports of both lower and higher dropout rates when comparing PSI with equivalent conventional courses. They list factors that tend to increase dropout rates (students delaying starting work on a course, putting off taking tests, procrastination) and others that assist in lowering those rates (publishing a recommended study schedule, access to entertaining lectures for students who have passed tests, possibility to take exams early, reducing the size of units).

In Keller's (1968) original form of PSI there are no completion time limits. If a student has not completed all unit tests at the end of the academic year, course work is carried forward, allowing the student to continue the course in the next academic year. This approach lets students progress at their own pace, without designing time pressure into the course. This original approach has been modified by many instructors, based on administrative barriers which prevent students from continuing in the next year and on the desire to reduce procrastination. For example, as described earlier, Brook and Thomson (1982) introduced a penalty system of deadlines and reduced marks to encourage students to follow a test schedule that facilitates course completion within the academic year. Others have limited the number of attempts per quiz or demanded that one unit has to be passed each week. Many changes to PSI have been implemented in practice and the question has to be asked, at what point do those changes counteract the core features of PSI to a degree that courses are no longer PSI courses? (Sherman, 1992; Buskist et al., 1991).

Buskist and colleagues (1991) also see that non-completion and procrastination can be issues for PSI courses. The students themselves are negatively affected and staff have high workloads towards the end of the term and have to deal with incomplete results. In their review of studies on procrastination, these authors noted promising interventions that are in line with the characteristics of PSI. These include an emphasis on teaching students time management skills and on working with students to set individual deadlines. They noted that "students who worked under self-imposed schedules missed fewer deadlines, showed accelerated pacing in their studying" when compared to students working under imposed deadlines (Buskist, Cush & DeGrandpre, 1991, p. 227).

Taveggia (1976) approaches the examination of procrastination in PSI courses by looking more closely at what happens in conventional courses. At the time of his research, a full year course would typically only have a few assessment points of midterm and final test/exams and term papers. This setup allows students to do very little over fairly long periods and then cram just before assessments. This is in contrast to a PSI course, where students can only advance to a new unit of material once they have demonstrated their mastery of the prior material. Importantly, they have to do all units and cannot skip material, asking for steadier

engagement with the material. Viewed this way there is less space for procrastination in PSI compared to conventional courses (Taveggia, 1976).

Decline of PSI

By the early 1990s the number of PSI courses and the research publications on the topic had sharply declined. In his reflections Sherman (1992) noted a number of reasons why the adoption of PSI had declined, despite the solid evidence of its positive impact on student learning and perceptions.

- Views of what teaching entails: In a PSI course the role of the instructor changes from lecturing to engaging with the students. This can be a challenging adjustment for academics and university officials (with reports of officials dictating how many hours of lecturing must be done in a course).
- Opinions over data: While solid evidence on the superiority of PSI was available from data gained in empirical studies, unproven opinions on what constitutes 'good teaching' overwrote this evidence (e.g., as with the insistence on lectures).
- Reluctance to change: Educational reform is obstructed by a reluctance to change anything that would disturb existing powers and vested interests.
- Challenges of drawing boundaries: While the major characteristics of PSI can be defined fairly easily, the challenges lie at the boundaries. Where those are stretched too far (deadlines, penalties, limits on test attempts), courses may no longer be true PSI course but failures fall back on PSI.

In their review of PSI literature, Grant and Spencer (2003) highlight the following reasons for a decline in interest in PSI: reluctance to change; modifications of PSI that failed to meet important PSI criteria; time demand of creating and supporting a PSI course; higher research demands on academics. The authors especially emphasise a further reason – the immaturity of education as a profession and with that reliance on subjective judgements over empirical data, leading to indifference towards PSI despite the strong empirical evidence of its effectiveness, something already alluded to by Sherman in 1992.

Newer research articles on PSI

The golden time of PSI was in the 1970s and 1980s, and Sherman's reflections (1992) can be seen as a summary of this area. Newer work has been published since, looking at the impact of technology and the potential for distance teaching. Interestingly, all newer articles we reviewed start by explaining what PSI is, where its strengths and challenges lie. PSI is introduced as a forgotten method, worthwhile of revival.

Rae (1993) discusses the teaching of a first year mathematics course to a class of 150 students with widely varying prior knowledge and interest in the subject area. The main technology used are video tapes, but the authors also experimented with video discs, computer delivered tutorials and early versions of computer-based instruction. In PSI style, lectures had been replaced with carefully prepared written material, supplemented by video recordings. For each course unit, a 30 minute video-recorded summary of the material is available. The advantages of videos compared to live lectures are highlighted. The student is in control, can stop the delivery and repeat sections as required.

A special feature are video recorded demonstrations of tutorial tasks. Tasks specifications are provided as written worksheets and students are encouraged to work through in their own time before looking at the video recordings. The recordings show the lecturer working through the tasks, demonstrating how to approach and solve those tasks step-by-step. The

video production is kept simple, alternating views between the lecturer and the solution steps written on overhead projector foils. The emphasis is kept on keeping the demonstration natural, much as observing the lecturer in real time. No editing is applied and the production overhead is described as 4:1, requiring 4 hours of production work per 1 hour of finished video. Interestingly, no sample solutions are handed out, to reinforce that students watch the videos. Students have access to university-supplied video recorders. Two sets of headphones per machine are provided to encourage students to listen and work through the recordings together. Rae (1993) describes the videos as huge success in supporting the students' problem-solving abilities.

To reduce resource requirements, compromises were made regarding testing and staff contact times. Each student had access to a weekly two hour tutorial, shared by 15 (later 20) students. This time was used for sitting unit tests and direct one-on-one conversation between staff member and student. There was a strong focus on relationship building. In a change to core PSI practice, the unit tests were treated as formative only and grades were derived from mid-term tests. Rae (1993) observes that this caused issues, with some students not taking the unit tests at all and others not wanting to await their turn in the tutorial slots to talk to the teaching staff.

In summary, Rae (1993) evaluates the course setup as highly successful. He estimates that staff had effective contact with about two-thirds of the class, which is described as much better than with lecture-based teaching or group tutorials (that address the students as a group and not individually). Rae (1993) highlights the effectiveness of the course by talking about the success of students in the course who have weak prior knowledge of math "it seems reasonable to claim that a significant number are now passing who simply could not be taught this material by 'chalk-and-talk'" (p. 49).

In 2007, Eyre identifies new technologies and the growing demand for distance education as factors in a potential revival of PSI. The widespread availability of computer and internet technologies now allows for efficient management of tests, permutation of questions, record keeping and marking. The author refers to assessment computer programs relevant at the time and to the increasing use of learning management systems. Her conclusion is that technologies provide effective solutions for the otherwise time consuming manual tasks around PSI test preparation, marking and record-keeping. With reference to previous research, Eyre (2007) re-iterates well-documented challenges for PSI courses. Courses with no restrictions on deadlines or number of test attempts run the danger of procrastination; attempts to enforce deadlines violate the core PSI principle of self-pacing. Eyre also picks up on issues around mastery requirements. While the original PSI approach by Keller (1968) allowed students to continue into a new study year, strict enforcement of study years or semesters have necessitated a reduction in requirements, with students being able to pass courses having completed only a reduced number of course units. Solving the issues around procrastination, pacing and mastery are seen as critical in the revival of PSI.

Looking beyond those issues, Eyre (2007) focuses on the promise of PSI for distance teaching. Carefully constructed written course material is common to both PSI and distance courses. Tests, facilitated via internet-based tools, can be developed towards a mastery approach. An important aspect mentioned is that the role of the lecturer in distance teaching already is more that of a 'mentor' or 'learning facilitator' as the presentation of live lectures in not feasible. This change in role should help negating the perception issues that lecturers need to 'lecture', which have caused issues for PSI implementations in the past.

Grant and Spencer (2003) also support the view that PSI is well suited to distance education, referring specifically to the emphasis on the written word and on the flexibility of the

method. Distance students benefit in particular from carefully prepared teaching material. The new computer and communications technologies are strong enablers for PSI style distance courses.

Macpherson (2016) suggests that PSI is a suitable approach to reduce 'math anxiety'. He defines this anxiety as "a negative attitude towards mathematics that is generally accompanied by worried thoughts, tension and fear, often leading to an avoidance of taking courses with mathematical content" (p. 124). Such anxiety also applies to other contexts where students are required to take compulsory courses in support of their major, such as biology and social science majors being required to take statistics courses. Math anxiety impedes learning. It is a common phenomenon that affects many more students than special support services could deal with. Solutions need to come from study design. Math anxiety is linked to poor instruction and instructors play a big role in the experience a student has with a course. Many students already enter university with the anxiety established, which is often developed at school level. Learner-centred teaching is important and needs to include the provision of both cognitive and affective empathy. Encouraging critical thinking is required, as are adjustments to different levels of abilities among students.

Comparison with other students is implicit in traditional performance-oriented goal setting. Performance goal orientation leads to focus on failures instead of success and to negative perceptions among students. In contrast, mastery approaches increase student interest in learning the subject, which in turn tends to lead to better performance. A focus on mastery of material instead of on marks helps to reduce math anxiety. This makes PSI suitable to combat math anxiety. Macpherson (2016) points out that self-paced approaches like PSI do not hold back advanced students. Those students do not have to wait for weaker students to catch up. Importantly, students who struggle are not intimidated by advanced students.

Several authors have pointed out that the learning-centred pedigree of the flipped-classroom arguably begins with mastery learning and active learning (e.g. Persky & McLaughlin, 2017) while others advocate explicitly combining mastery assessment with a flipped model (e.g. Bergmann & Sams, 2012). We provide a further example of the literature related to flipped-classrooms in a later section of this review in the context of self-determination theory.

Thinking about reviving PSI in 2018

The core principles of PSI seem today as valuable as in the 1970s. The reviews regarding the effectiveness of PSI are overwhelmingly positive. Is it possible, after close to 50 years, to revive the original, uncompromised ideas of PSI?

In many ways, the progress made in higher education over the last 50 years is limited. As a profession, higher education still appears immature. There is reluctance to change and administrative hurdles are still hard to overcome. The value the system puts on research is far higher than on teaching, and research on teaching and learning has made only limited inroads, despite the work of Boyer and others on the Scholarship of Teaching and Learning (Boyer, 1990; Kern, Mettetal, Dixson, Morgan, 2015). While there is good work in this area, this does not mean that the new knowledge is applied when designing programmes and approaches. Sherman (1992) talked about measures suggested to achieve improvements in student achievement as "identifying and rewarding 'great teachers', instituting a teacher accountability system (like outcome-based instruction), setting standards for teacher training and certification" (p. 61). At the time he acknowledged that there might be merit in those measures but pointed out that, "they all leave intact the basic procedures of teaching, the relation between the student and the information presented" (p. 61). We now have institutional and national awards for great teachers. Teachers have far greater accountability

(see TEC's framework of performance linked funding that establishes minimum pass rates for courses to retain funding, TEC, 2018b). Many universities run teacher training courses and have signed up to certification systems like the Higher Education Academy. Yet we suggest that, true to Sherman's prediction, teaching in higher education at its core has not changed.

Some of the student factors have changed compared to the 1970s and the following decades. Now a higher proportion of students study part-time, work at least part-time and have commitments in caring for family members. We have more distance students and students who study off-campus, facilitated by improved information and communication technologies (Kahu, 2014). Yet, looking at many of our first year courses, the challenges of teaching students from widely different backgrounds and interest areas as one cohort have not changed. Brook and Thomson (1982) and Rae (1993) already commented on the variety of knowledge among their students and the mixture of majoring students who are interested in the subject area and those who just do a course because it is compulsory.

Using the figures provided by Brook and Thomson (1982), about 2.5 hours of proctor support per student per week were available to support their PSI course taught to 750 students (transferred into a semester system). Those 2.5 hours must have been above the norm, as the PSI literature generally reports on how resource intensive this form of teaching is. A quick informal survey among colleagues teaching first year teaching courses in the mathematical and information sciences indicate that we are closer to 1 to 1.5 hours of casual support (mainly for marking and lab supervision) per student and semester today. We also have not experienced a higher allocation of permanent staff to those courses. Despite all the research into the importance of first year undertaken over the last decade which points to the need for additional resources, the resources available to staff teaching first year do not seem to have increased.

One area that has certainly changed tremendously over the last 50 years is that of information and communication technologies. Already back in 1993 Rae details the effective use of videos to support his PSI course. Eyre (2007) reports on several computer-based systems and the growing importance of learning management systems. Today, we can hardly imagine teaching a course without modern technologies. We provide online repositories of teaching material, record lectures, run quizzes, handle assignments, conduct discussion forums. Yet, have we, for example, achieved the 'didactic conversations' between students and tutors Holmberg asked for in 1981 in the context of distance education? Our own observations are that we have far too few didactic conversations with our students. We certainly do not reach the effective contact with about two-thirds of the class Rae (1993) reports from his PSI course. While technologies theoretically provide us with the opportunities, how many of our students, on-campus and at distance, complete (or fail) our courses without ever having engaged in a robust learning conversation with either staff or peers? This is a complex issue. Technologies, e.g., for recording of material, create opportunities where access would otherwise not be possible, but also make it easier to stay at a distance, physically as well as in terms of personal interactions and engagement.

This leads us to the following key observations:

- The challenges and needs of first year teaching at university today are sufficiently similar to those in the 1970s that we want to revive PSI.
- Learning from the problems reported about modifications of PSI principles, we want to go back to the original form as presented by Keller in 1968.
- The key challenges to a successful implementation of PSI still exist. We hope to address those as follows:

- o Drawing on self-determination theory to address challenges like procrastination.
- o Building on research into first year student experiences to mount arguments for the need for change and the need for better resourcing.
- o Learning from how we have used learning technologies over the last decade and taking another step forward in the effective use of technologies (e.g., in conducting face-to-face conversations over distance).

In our conversations with colleagues we have noticed a hesitation on hearing about mastery assessment, which seems to trigger negative connotations linked to splitting material into small units and learning for the test instead of for knowledge. Grant and Spencer (2003) mentioned the potential criticism on PSI stemming from its reference to behavioural principles. They stated that important PSI principles like dividing material into units, mastering learning material, peer or instructor support had been used in many contexts of learning and instruction well before PSI. While we noted that many PSI articles refer to tests (as in short-answer or multiple choice), PSI is open to many forms of assessment. Grant and Spencer write (2003):

> "PSI only demands instructional content that is amenable to observable assessment in the form of unit quiz scores or some other type of performance (e.g., essay-writing, first-aid skills demonstrations, lifesaving demonstration, debating exhibition, poetry writing, experimental design and execution) that may be assessed and graded according to clear and fair criteria." (p. 6)

Maybe we can follow Taveggia (1976) who referred to 'unit perfection' and focus on 'achievement of learning objectives', building on a term used nowadays in the context of constructive alignment (Biggs & Tang, 2007).

2.2 Self-Determination Theory (SDT)

Many researchers have contributed to the development of SDT. In our review we initially follow key articles Ryan and Deci, two of the main researchers in this area, before looking at articles that focus on SDT and education, on SDT and testing, and on more recent applications of SDT.

The origins of self-determination theory and the focus on three basic psychological needs

Self-determination theory (SDT) is a meta theory that draws on two main strands of theories developed in the 20th century (Ryan and Deci, 2002). One strand comes from theories of personality and development, stating that people intrinsically strive towards psychological growth and integration of new experiences into a unified self. Autonomous, responsible behaviour as well as active, curiosity-based exploration are seen as intrinsic characteristics. The other strand stems from behaviourist theories and social-cognitive approaches. The former emphasizes the impact of organized and systematic outside influences on the development of personality. The latter focuses on personality as a collection of selves, each influenced by separate outside influences. There is strong evidence for either strand of perspectives on human development and personality, derived from theoretical arguments as well as observations. Besides the theoretical considerations, there are practical implications. If one believes in an inherent tendency towards growth and self-development, one strives to support this inner drive. Without this belief the focus is on providing outside values to direct behaviour (Ryan and Deci, 2002).

Ryan and Deci (2002) position SDT as a theory that draws on both strands. It is based on the belief that every person has an inherent drive towards growth and development, towards

developing a holistic self that is also well connected with other individuals and social contexts. Yet, SDT also acknowledges the crucial role external influences have on human development. Those influences can either support or hinder the fundamental inherent drive towards self-development. Thus, the development of an active, integrated self or conversely, a passive, alienated self is facilitated. Humans have inherent potential but require positive outside influences for a healthy development.

SDT draws on basic psychological needs to assess if a social environment promotes or hinders desired outcomes (Ryan and Deci, 2002). The theory posits that the fulfilment of basic psychological needs is essential for growth and wellbeing, just as the fulfilment of physiological needs, such as thirst and hunger, is required for physical development. The basic psychological needs are seen as innate and universal, meaning they are present across cultures and developmental periods. The focus on basic psychological needs means factors in social environments that promote self-motivation and well-being can be identified and compared to those that hinder initiative and positive experience.

Ryan and Deci (2002) name three basic psychological needs:

- Competence: One feels competent if one is satisfied with one's interactions with others and has opportunities to act according to one's own abilities. When feeling competent one seeks development opportunities.
- Relatedness: This is about feeling connected to others, about belonging to a community. This comes from an inner drive to connect with others and be accepted.
- Autonomy: This is about being driven by one's own interest and values. While those actions can be influenced or requested by others, it is important one endorses them, to provide a feeling of initiative and value.

Self-determination theory and motivation

Ryan and Deci (2000) examine intrinsic motivation, self-regulation and well-being in the context of SDT. Where the three basic psychological needs of competence, autonomy and relatedness are met, intrinsic motivation and self-regulation rise and well-being is enhanced; if those needs are not met, intrinsic motivation and self-regulation and well-being suffer.

Summarizing the work of other researchers, Ryan and Deci (2000) distinguish between people who carry out actions based on intrinsic motivation and those who act based on external controls. Intrinsic motivation leads to many positive outcomes compared to acting on external controls, even at the same level of perceived competence or self-efficacy. These include: increased interest, excitement, confidence; enhanced performance, persistence, creativity; heightened vitality, self-esteem and well-being. Based on these manifold positives, SDT research has focused on the conditions that elicit and sustain intrinsic motivation. The following factors were found to increase intrinsic motivation: choice, acknowledgement of feelings, and opportunities for self-direction. In contrast, factors that lead to decreased intrinsic motivation include tangible rewards based on task performance, threats, deadlines, directives, and pressured evaluations.

The realities of life require people to carry out tasks for which they do not feel intrinsically motivated. Intrinsic motivation implies that the reward stems from the satisfaction of doing an activity. In contrast, doing something out of extrinsic motivation means that activity and reward are separate. Enjoyment is not derived from the activity itself, but the activity relates to an external reason. Ryan and Deci (2000), collating findings across publications, discuss intrinsic and extrinsic motivation in parallel to a continuum from non-self-determined to self-determined behaviour:

- Amotivation (related to non-self-determined behaviour): limited intention to act; going through the motions; linked to not valuing an activity, not feeling competent, not expecting a desired outcome.
- Extrinsic motivation (between non-self-determined and self-determined behaviour):
  - External regulation: driven by external demand or reward; behaviour experienced as controlled or alienated.
  - Introjected regulation: driven by external demands that have only partially been internalized; activities done to demonstrate ability or maintain feelings of worth.
  - Identified regulation: pursuing an action is consciously valued; the action is seen as personally important.
  - Integrated regulation: the value of doing an action is internalised and in harmony with one's other values and needs; the value of doing the action does not derive from the action itself (as it would with intrinsic motivation).
- Intrinsic motivation (related to self-determined behaviour): doing something for its inherent value.

The more self-determined a behaviour is, the more internalized are the reasons for acting. Greater internalization brings benefits for effectiveness, persistence, well-being and social integration.

Ryan and Deci (2000) continue their explorations of SDT by discussing how internalization can be facilitated and how extrinsic motivation can be shifted to the more self-determined end of the spectrum. As externally motivated actions are often prompted by people one values, a close relationship to those people is important for internalization. It helps to feel connected. Internalization is also facilitated by being asked to do activities one feels competent to carry out. A further factor relates to autonomy. In addition to competence and relatedness, the context for an activity must facilitate autonomy, or, in other words, must not encourage external regulation such as via rewards or threats. Autonomy refers to doing something out of free will. Ryan and Deci (2000, p74) state:

> Accumulated research now suggests that the commitment and authenticity reflected in intrinsic motivation and integrated extrinsic motivation are most likely to be evident when individuals experience support for competence, autonomy, and relatedness.

Ryan and Deci (2000) conclude by emphasizing the importance of providing contexts that facilitate competence, autonomy, and relatedness when trying to motivate others to carry out tasks with commitment and effort to a high quality level.

Self-determination theory and its relevance for education

There is strong evidence that SDT is relevant to education (Niemiec and Ryan, 2009; Reeve, 2002). This applies across all educational levels and across cultures (Niemiec and Ryan, 2009). In an ideal world, students would be fully intrinsically motivated. Yet, this is unrealistic and students in educational settings need to perform tasks for which they are not intrinsically motivated. SDT identifies different levels of self-regulation in extrinsic motivation (see the earlier description of motivation based on Ryan and Deci, 2000). The higher the level of self-regulation and the more autonomous the motivation (as in identified or integrated regulation) is, the better educational and personal outcomes are (Reeve, 2002). It is therefore important to assist students in internalizing motivation and facilitating self-regulation (Niemiec and Ryan, 2009). Drawing on a number of research studies, Reeve (2002) lists how students benefit from autonomous motivation and from autonomy-supportive teachers: higher academic achievement, higher perceived competence, more positive emotionality, higher self-worth, higher self-esteem, preference for optimal challenge,

greater conceptual understanding, pleasure from optimal challenge, greater flexibility in thinking, stronger perceptions of control, more active information processing, greater creativity, higher rates of retention.

Besides the need for autonomy, SDT also posits that the basic needs of competence and relatedness have to be fulfilled. Students' need for competence is related to learning tasks that are optimally challenging. Students need tasks they can master but tasks should also test and expand their capabilities (Niemiec and Ryan, 2009). To internalize motivation, students need to be able to personally value the learning activities, feel a sense of belonging to the learning context and feel liked, respected and valued by the teacher (Niemiec and Ryan, 2009).

Having established the benefits of support for autonomy building, Reeve (2002) investigates autonomy-supportive versus controlling teacher behaviours and explores the impact of either type of teacher behaviour on students. He states that autonomy-supportive teacher behaviour was found to have a strong positive impact on students' perceived self-determination and competence. Reeve (2002) concludes that teachers can learn to be autonomy-supportive and summarizes what autonomy-supportive teaching looks like (p190):

> *As to one's interpersonal style of teaching, autonomy support requires a willingness to enter into relationships from the students' perspective to encourage initiative, nurture competence, and communicate in ways that are non-controlling and information rich. As to interpersonal skills, autonomy support involves acquiring talents such as perspective taking, acknowledging feelings, providing rationales for uninteresting lessons, recognizing interest in others, and so on.*

Reeve (2002) provides several reasons to explain why teachers often demonstrate controlling behaviour: teacher training conditions teachers towards controlling behaviour; conditions like class sizes and accountability put teachers under pressure to which they typically react with controlling behaviours; teachers have the wrong beliefs that extrinsic incentives will lead to the best results; cultural expectations of teachers imply strong behaviours such as taking control and giving directives; misunderstandings that autonomy-supportive behaviour means a lack of structure. Niemiec and Ryan (2009) also point towards external pressures on teachers. As teachers experience controlling behaviours themselves, as caused for example by pressure the achieve performance standards, they act more controlling with their own students.

Self-determination theory and testing

Ryan and Weinstein (2009) examine high-stakes testing in the light of SDT. High-stakes testing is applied across many countries. It serves the dual purpose of examining student advancement and provides a basis for either rewarding or sanctioning education providers. The problems caused by high-stakes testing are widely recognized and SDT provides the theoretical foundation to explain the issues (Ryan and Weinstein, 2009).

SDT emphasizes the importance of self-regulation or autonomy. Autonomy-supportive behaviour is far more beneficial than controlling behaviour (see previous section). High-stakes test have a controlling effect on the school and on teachers, prompting more controlling behaviours and leading to a negative effect on students. While there can be short-term gains (through studying for the test), Ryan and Weinstein (2009) point to a number of negative effects on students and teachers: superficial learning, undermining of complex learning, loss of interest, lower self-motivation, more anxiety; teaching to the test, more controlling behaviour, lower teacher moral, less educational innovation. While SDT asks for optimal challenges, high stakes testing follows a one-size-fits-all maxim. Weaker students are over-challenged and get demoralized, stronger students are under-challenged and get bored.

High-stakes testing creates the temptation for manipulation. For example, to produce favourable results by controlling which students are allowed to take which tests (Ryan and Weinstein, 2009).

Ryan and Weinstein (2009) emphasize that tests can have an informational function and as such can assist both learners and teachers. Tests in themselves are not negative events; their effect depends on their functional significance (Ryan and Weinstein, 2009, p226):

> *... to the extent that an event [a test] is experienced as informational, it tends to have a positive impact on self-motivation, enhancing both feelings of competence and autonomy.*

2.4 Recent studies in higher education based on self-determination theory

In this section we briefly introduce recent studies undertaken in a higher education context that build on SDT as theoretical framework in order to demonstrate the current interest in SDT and its relevance to our work.

Martin, Kelly and Terry (2018) suggest that the principles of SDT, the importance of fulfilling the three basic needs of autonomy, competence and relatedness, and of self-directed motivation, can be applied to examine engagement within massive open online courses (MOOCs); an environment where dropout is the norm and students are free to leave at any point. They found early evidence that MOOC design based on SDT does have utility in promoting engagement. Even so, as the authors note, their study is a first iteration in a design-based research project and further cycles including design by learning designers external to the project are required to determine whether the results are generalisable and repeatable.

Twembeke and Goeman (2018) look at a flipped classroom approach from an educational change perspective. They focus on how lecturers can be supported in changing their teaching to a flipped approach. SDT and change management are combined to look at the intrinsic motivation of lecturers for introducing the flipped approach and at systematic change at organisational level. The authors develop a conceptual model and emphasize the importance of intrinsic motivation for educational change.

Butz and Stupnisky (2016) use SDT to examine synchronous hybrid learning environments. In these learning environments on- and off-campus students are taught synchronously with the help of web-conferencing tools. The study specifically focusses on how students experience relatedness. It was found that the relatedness between students of the different modes was significantly lower than among students of the same modes, on-campus as well as off-campus. Further, the off-campus cohort experienced lower relatedness than the on-campus cohort. The results of the study point to important connections between perceptions of relatedness, intrinsic motivation and success. One of the recommendations is to establish open virtual spaces, allowing students to meet, form connections and collaborate.

Vanslambrouck, Zhu, Lombaerts, Philipsen and Tondeur (2018) examine student perceptions of costs and values in online and blended learning environments, with the goal of assisting teachers in adjusting their approaches to better meet student needs. The specific challenges are seen in the diversity of students taking courses in these environments. The researchers base their work on SDT and expectancy-value theory. The costs of participation identified include generic challenges of time requirements impacting on families, relationships and work place, as well as issues specific to online and blended learning environments such as technology problems and difficulties in organising group work. Based on the different forms

of self-regulated motivation presented in SDT, the researchers identified various motivational profiles. They posit that teachers could support students by being aware how values and costs are related to motivational profiles.

Dyrberg and Holmegaard (2018) use SDT as a theoretical framework to investigate students' motivation in two large STEM courses taken by students from various study programmes. The researchers found differences in the motivational patterns among students taking courses as parts of majors or as compulsory subjects. A lack of interest in a subject area, e.g., in biology for a physics student, was followed by reduced levels of self-directed motivation and linked to lower quality learning. Among the conclusions of the study were recommendations to teachers to better explain how knowledge from the various disciplines interacts.

Wilkesmann (2013) combined SDT with principal-agent theory to investigate the effects of transactional and transformational governance in universities on the perception of significance attributed to teaching in universities. The findings show that transactional governance, which relates to the use of external motivation, does not increase the perception of the significance of teaching. On the contrary, transformational governance is related to self-determined regulation and has a positive impact on the perception of significance attributed to teaching. It is also linked to student-focused teaching approaches. Consequently, improvements in teaching at universities do not require external incentives or controls, but elements such as recognition from top level university leaders, a culture in which it is normal to discuss teaching and that welcomes innovation, and the right support in terms of resources and time.

These varied studies demonstrate the utility of SDT in examining the characteristics of teaching approaches and environments. While the origins of SDT of stretch back to the 1970s, with a strong uptake of the theory in the 2000s, the studies cited show that SDT is relevant to our current technology-supported learning environments. There is also ample evidence that SDT can be used as theoretical framework to examine learning approaches, like the one we propose, based on PSI. Even so, while SDT is supported by strong empirical evidence, it arguably sits within the natural-scientific or human-scientific perspectives of psychology (Walsh, Teo, & Baydala, 2014). It is important not to abandon a third, critical perspective. As Zepke (2018, p442), writing about student engagement, points out, it is *'critique that stimulates agency'*. The lens of SDT should be applied with a strong reflective approach and an awareness of work in the areas of critical pedagogy (e.g. Zepke) and critical theory (e.g. Freire). Like all theories, it is open to challenge and to change.

3 Conceptual description of our approach

Earlier in this report we have established that we want to build on PSI. We now want to extend the description of our planned approach, based on our further explorations of the literature. We provide a conceptual description and argue that our approach aligns with the literature on PSI and SDT. In the appendix to this report, we briefly explore practicalities, including costs and resource requirements.

Our context is the teaching of first year, semester-long university courses in mathematical, science or technology disciplines. We address both on and off campus students. Our approach might also be suitable for other disciplines, such as finance or accounting, as well as courses higher than first year.

3.1 Our proposed approach

- Start and completion: A student can start a course and complete a course outside the usual university time periods. This means that enrolment is possible outside standard times and a grade will be assigned and completion officially confirmed outside traditional examination periods. A student can start a second flexible course immediately after completion of a first flexible course without having to wait for the start of the next semester.
- Pacing: It is up to students how they progress through a course. Progress is dependent on fulfilling course requirements. No deadlines are enforced.
- Course material: All course material is provided for self-study in formats such as video recordings or written material. Exercises and review questions are provided.
- Criteria to pass a course: To pass a course a student must demonstrate achievement of all learning objectives. A course has 3-5 learning objectives. For each learning objective criteria are specified that are used to assess if a student has achieved the objective. On achievement of all learning objectives a student can apply to sit a final test. The mark achieved in this test decides the student's grade (having achieved all learning objectives gives the student a passing grade).
- Achieving a learning objective: A teaching staff member decides if a student has achieved a learning objective. To do so the staff member has a conversation with the student about material the student has prepared (e.g., a collection of solutions to tasks relevant to the learning objective). The staff member will ask questions or seek explanations on the work the student has done. In reference to a marking scheme the staff member will decide and explain if the student has achieved the learning objective. If yes, the student moves on to the material for the next learning objective; if not, the student revises their work based on the feedback received to prepare for a further conversation.
- Purpose of the final test: The final test examines the student's overall understanding of the course material. The test, likely a combination of multiple choice and short answer questions, draws on material from all learning objectives and focuses on integration of knowledge across all course material. The test is summative and determines the passing grade a student receives.
- Personal study plan: When starting a course, students have to prepare their personal study plan. In this plan they propose their own personal schedule. For example, this will contain proposed dates for the learning objective conversations and a schedule for going through the sections of the course material and exercises. This plan will form the basis for support provided by a staff member. The staff member will check with the student the utility of the schedule and assist in adjusting the plan in line with the student's own goals (e.g., their expectations on the timeframe for completing the course).

- Support: Staff are available for individual student support. Students can seek help via direct contact or class-based tools (e.g., discussion forums). Staff will approach students based on their personal study plans. Staff and students will have conversations around achievement of learning objectives.
- Class activities: Tutorials or discussions with groups of students will occur on demand (e.g., via discussion forums, prompted by student questions). There might be occasional lectures on material related to the course. Attendance/watching will not be necessary to pass the course.
- Learning spaces: Students will be provided with open learning spaces that can be used for self-study, conversations with peers and occasional group class activities. Support staff will be located in close proximity and be ready to assist students. The conversations around achievements of learning objectives will occur close to the open learning spaces in private rooms. Online open learning spaces will be created to enable off-campus students to interact with peers and staff. This might be achieved via open video conversation connections.
- Peer support: Students will be encouraged to work together on course material and tasks. This can occur via the shared learning spaces provided or based on student initiative. Working together will not normally be a requirement.

3.2 Comparing our approach with the personalized system of instruction

Our approach closely builds on PSI in the original form proposed by Keller in 1968. In Keller's plan students had to pass all course sections. Students could carry over course work they had not completed into the next study year. Later versions of PSI courses (e.g., see Brook and Thomson, 1982) show that students could pass a course with having covered only parts of the material, to avoid high failure rates and administrative complications. Consistent with Keller's original plan, we want to insist on achievement of all learning objectives. We see this as critical to students gaining solid knowledge foundations. If a learning objective is important enough to be specified for a course it should be essential that students demonstrate having achieved the objective. We do not think that it is of benefit for individual students, the university or society to enable students to pass a first year course with knowledge that only achieves some of the learning objectives. In the past, the lack of computerized administrative systems meant the overhead of keeping track of individual students over and between courses was high. Today, with modern information technology tools, such tasks should be manageable. We are aware that university administrative procedures at the moment lack the flexibility we require for our approach. We have outlined our explorations in Appendix B and believe that these hurdles can be overcome.

The descriptions of past PSI courses imply that students had to wait to the end of the study period (usually a year at the time) to sit the final exam for a course. We want to handle this more flexibly to allow students to sit a final exam or test shortly after they have achieved all learning objectives for a course. We have two related reasons for this. First, from a learning perspective, it makes more sense to be tested on the material when the material is still 'fresh', e.g., after a two-week test preparation study period. Having to wait a long time, e.g., six or eight weeks, for the final test seems to put an undue burden on a student. Second, being able to complete a course early, without waiting for the end of an official study period, should provide an incentive to get on with the study. This should counteract procrastination, in particular, if a student can begin a second course immediately after they have completed a pre-requisite or first course. Keller's 1968 article already remarks on how it would make sense to allow students to move forward based on their own achievement schedule.

While PSI in theory always allowed for a variety of assessment types, examples in the literature are dominated by references to tests. While we do not plan to exclude tests, we want to focus on assessments that allow students to demonstrate their understanding in richer forms. Our students will prepare reports, perform calculations, or develop programs based on a range of task specifications that we will make available for each learning objective. Once a student has completed the relevant tasks, they can ask for an assessment conversation. As described in the PSI literature, a staff member will engage with the student in a conversation about their work, probing student understanding by asking 'why' and 'what if' questions. Instead of using a numeric system (e.g. 90% of questions answered correctly means achieved) we will use marking criteria as the basis for judging achievement. The marking criteria, available to the students upfront, will be discussed with the student in relationship to their work in the assessment conversation. Once the student has performed well with respect to all marking criteria, they can move on to the next learning objective. Where the student needs further work, it should be clear from the feedback the student receives in the assessment conversation, what needs to be done.

With this approach we are confident to be able to achieve the benefits of PSI reported in the literature.

3.3 Comparing our approach with self-determination theory

SDT states that the three basic psychological needs of autonomy, competence and relatedness have to be fulfilled to increase self-regulated motivation. By facilitating self-regulated motivation, we increase the likelihood that students engage in meaningful learning. In the following paragraphs we theorize how our approach relates to the core SDT concepts and how this should help to address the challenges of PSI.

Our approach supports competence by allowing students to study based on their own abilities. As the learning material is provided upfront students can proceed at their own pace. They can choose to repeat sections, e.g., by re-playing video material, or focus on selected material, e.g., by looking at the text of lecture slides only without listening to the audio commentary. Students can select exercises and tasks according to their level of understanding, building up slowly or going straight to the more advanced material. As students set their own timelines, they can work through the material based on their own abilities, slower or faster than in a standard course delivery.

The way assessment is handled also reinforces the need for competence. Once students have achieved a learning objective they can be confident that they have the knowledge and skills required for this section of the course. They have the right foundation to move on to other material. If students have not yet achieved a learning objective, they receive clear feedback, linked to marking rubrics, showing which aspects they need to work on. Importantly, students can take the time to revisit these areas. The assessment is not based on comparisons between students but focused on the student and the course material.

Our approach supports relatedness by creating close contact between students and staff. This starts with the development of the personal study plan each student develops with the help of a staff member. This is based around the personal circumstances of a student, such as pre-existing knowledge, time commitments, workload, and goals. Our assessment conversations are one-on-one, face-to-face conversations between student and staff member. They are focused on the work the student has provided and on their individual strengths and weaknesses. An important feature of these assessment conversations is that we normalize conversations between students and staff. These conversations are not about needing to seek help or being talked to due to poor performance but become a normal aspect of taking a

course. Strong as well as weak students will have those conversations several times throughout the course, always adjusted to a student's individual needs.

The assessment conversations will be easier for the students if they already have a relationship with the staff member. To facilitate this, we will schedule introductory meetings for small groups of students. Our learning spaces will also contribute, as staff will be close by. We are confident that conversations between staff and students will develop. Students will know that they have to seek the help they need to solve the tasks given, as they have to acquire the knowledge to achieve all learning objectives.

Relationships among students are also an important aspect to achieve relatedness. Our approach will facilitate connections among peers by reducing the competitive aspects of assessment, by facilitating getting to know each other in introductory meetings, by facilitating the forming of study groups among students working on the same learning objectives, and by providing suitable learning spaces. Importantly, we can encourage our students to collaborate on tasks, including the tasks to be solved in preparation for the assessment conversations. We do not need to fear that students might present work prepared by others, as our conversations will immediately show if a student understands the work presented. If they understand, the collaborations will have been helpful to get to this point. Should they not understand, we will send them back to work on the material further. Plagiarism will not be an issue as our assessment focuses on how students explain the work presented, not on the work itself.

Our approach supports autonomy by allowing students to set their personal directions. For example, students determine when and how to work on course material and tasks and when to put themselves forward for assessment conversations. Teachers reinforce autonomy seeking by engaging with the individual student at their level of competence, encouraging further learning and initiative. Autonomy, competence and relatedness encourage the development of self-regulated motivation.

Related to the fulfillment of the three basic psychological needs SDT emphasizes the importance of autonomy-supportive teacher behaviour. We foreground autonomy-supportive teacher behaviour by creating an environment that allows for this. For example, removing deadlines that staff need to enforce and defining the role of staff as one of supporting students; creating space for direct interactions between staff and students to discuss learning material; shifting the teacher role from having to control to being allowed to nurture. The degree to which we achieve this will depend on several factors. Teaching staff will need to be open to developing autonomy-supportive skills and be willing to work on their interpersonal skills. We need to work with university management to identify opportunities to support staff working in these roles and to ensure adequate resourcing.

Our approach aims to create a learning environment that supports the development of self-regulated motivation through addressing autonomy, competence and relatedness. Students who achieve high levels of self-regulated motivation should cope well with our courses. While we plan to provide comprehensive assistance, there might be students who do not achieve high levels of self-regulated motivation, or who experience mostly external or introjected regulation; these students may struggle to pass our courses. Yet, we suggest that these students will also not do well in a conventional deadline driven course, where they will either fail or pass with borderline knowledge.

Dropout rates and procrastination are the two challenges discussed in the context of PSI. We need to discuss these issues on multiple levels. First, by explaining how our changes to PSI should assist with these challenges. Second, by exploring what we want to achieve with our

approach compared to traditional deadline-driven courses. As we have outlined, our approach is consistent with SDT and is likely to strengthen self-regulated motivation. We support students in developing their personal study plans. Students are more likely to adhere to self-imposed deadlines based on intrinsic motivation than to externally enforced deadlines. In our approach students only move to new subject areas once they have understood the previous material. Students build on solid foundations and gain confidence that they can solve new challenges. This should allay potential anxieties that might stop students from progressing. Heightened levels of self-regulation, self-imposed schedules and confidence in one's abilities should be strong factors in reducing dropout rates and procrastination. For our strong students there is an additional factor. In our system these students can move on to follow-up courses as soon as they have completed the current course. This should be a strong incentive for those students to work at their own, faster pace.

In comparison to traditional deadline-driven courses we have three ambitious goals for our approach: enable more students to pass; enable stronger students to move on faster; ensure that all students who pass do so with solid knowledge and skills. We suggest that stronger students are less likely to procrastinate in our approach as they can see the benefits in getting on with the tasks at a faster pace. This reduces the danger of leaving work to the last minute before a deadline or missing the point in a course where material becomes more challenging and even stronger students have to invest time. At the other end of the spectrum we have weak students. The work those students submit at a deadline in a traditional course is likely below standard. Marking results are provided a few weeks later, confirming to the students that they have gaps in their knowledge. In the meantime, the course has progressed, leaving students struggling with both the new and old material. Frustrated, the students either officially withdraw from the course or stay on but fail. We cannot promise that our approach will allow every student to pass. Yet, we are certain that our approach will provide greater opportunities for both weak and strong students. Our support systems and lack of external pacing will allow students to incrementally build their knowledge. Importantly, it should also provide students with a better experience, allowing them to emerge as confident self-directed learners. While some students will need longer than the standard semester duration to pass our courses, they will be in a much stronger position than if they fail, have to repeat or simply scrape through a conventional course. Our goal that all students who pass have solid knowledge and skills could challenge our completion rates. Yet, to us, the alternative is unacceptable. Less than solid knowledge and skills means taking gaps and poor study habits forward into subsequent courses, leading to failure there and to pressure on letting students pass those courses. Ultimately, this leads to a devaluing of qualifications. Our position is that by providing highly supportive learning environments and flexibility, we provide students with real opportunities to gain solid knowledge and skills. We cater for students with weaker knowledge foundations, for students who have substantial outside commitments, and for students who require more time to adjust to university studies. Students who are prepared to invest themselves and take up the opportunities provided should be able to pass our courses.

Based on these observations we suggest that our approach is compatible with SDT and is likely to assist students in developing high levels of self-regulated motivation, encouraging meaningful learning and leading to significant knowledge. We suggest that our extensions to PSI strengthen the fulfillment of relatedness and autonomy and therefore will be helpful in reducing procrastination and dropouts.

4 Input from interviews with university staff

Direct contact between students and staff is at the heart of our new approach to teaching first year courses. Besides studying the literature, we saw it as important to learn from staff who already are in close contact with students as part of their teaching or support roles. We interviewed staff with experience of teaching in disciplinary contexts as well as those providing more generic one-to-one learning support.[1]

4.1 Participants

We selected potential interviewees based on their roles in teaching at first year level and in providing both study support and support for literacy and numeracy skills. All individuals we approached had been identified by our networks as experienced teachers with excellent reputations. Ethics approval in the form of a notification to our university's ethics committee was obtained for the study and all individuals we approached agreed to take part. We refer to those participants as P3 to P11. One participant requested that their specific comments not be used in any published material without prior approval and we have obtained this approval. Additional detail about participant roles and demographics are included in Appendix A.

4.2 Interview setup and questions

All interviews were conducted by the same researcher. Audio from each interview was recorded and transcribed. Each transcript was verified by the participant concerned. All interviews lasted approximately 45 minutes.

Interviews were semi-structured and the schedule covered:

- Student support meeting structure and mode: Questions about the environment in which a participant provides student support.
- Student-staff interactions: Questions about how participants structure support sessions with students.
- Professional experience: Questions about how participants evaluate their impact on the development of students they see.
- Personal experience: Questions about how participants perceive their roles.
- Feedback on the proposed mastery approach: Information on the context of this study was provided and the participants response to a flexible, mastery approach to teaching was sought.
- Invitation to make concluding comments.

While the interview schedule provided a guideline, the sequence and detailed follow-up questions varied between participants. Variation in questions was largely a function of participant background and work context.

4.3 Approach to analysis

Two distinct approaches were followed to analyse the interview transcripts. The first approach was semi-automatic and used techniques from corpus linguistics to identify the context for keywords and phrases taken from questions covered in the interview schedule. Representative responses were then extracted as an illustration for each question area.

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[1] In the interviews we referred to mastery learning and assessment as we not yet had proposed a shift in terminology to 'achievement of learning objectives' (see Section 2.1 'Thinking about reviving PSI in 2018'). We retain reference to 'mastery' in the report from the interviews to stay close to what has been discussed before changing to our new terminology in subsequent sections of this report

Finally, word and multi-word unit frequencies in the participant responses were calculated to check for any new topic areas not already focused on by the researchers. The second approach relied on close reading of the transcripts to identify emerging themes. Following this, the emerging themes were studied and consolidated. Consolidated theme names were then grouped to topic areas. All interview sections related to consolidated themes were re-read and descriptions written up. This process involved making adjustments to the labelling scheme and refinement of the themes and topic areas. The topic areas and themes identified from both approaches were then summarised and integrated.

4.4 Key findings from interviews

We divided the analysis of the interviews into the six categories of pre-course factors; course implementation factors (this section includes main comments specific to our mastery proposal); support systems for students; support systems for staff; student factors and staff factors. Appendix A details what our participants said and presents direct citations. We then examined how the statements made by our participants relate to our proposal in terms of providing endorsements of our ideas, voicing cautions for us to consider or suggesting insights to build on in implementation. While Appendix A details our discussions, Table 1 provides a summary of key findings.

Table 1 Key findings from our interviews with experienced first year teachers and student support staff.

Type	Learnings
Endorsements	Change to how we currently teach and support students is required
	Students need time to adjust to university study
	The abilities and support needs of students vary greatly
	Importance of formative feedback in supporting student learning
	Allow students to learn without being punished in their grades
	Real potential for student learning in a mastery approach
	Plagiarism can be avoided by course/assessment design
	Mandate conversations with staff to reach all students and open up communication channels
	With adequate introduction time, communication over distance mediated by video conferencing tools is as close to effective as being in the same room
	Provide learning spaces in which students feel comfortable to spend time and work
	Staff derive satisfaction from facilitating student learning in direct contact with students
	Staff have the ability to assess student skills and directing student learning
Cautions	Issue of students not having access to technologies
	Concern relating to procrastination and lack of external deadlines

	Danger of less peer contact due to limited shared lectures and tutorials
	Times required for support tasks can vary considerably
	Not all students will eventually will become independent, motivated learners
	Cultural competence is required to support all students well
Insights for implementation	Work together with the university sections on course advice and support
	Integrate support for generic study skills
	Clear communication about course requirements and consistent messages across members of teaching team are important
	Selection of communication technologies selected with student preferences in mind and clearly signalled
	Encourage students to set themselves deadlines
	Need for flexibility in scheduling and conduction support meetings
	Provide support at times useful to students
	Think carefully about what system is good for keeping records of conversations between students and staff
	Importance of building relationships with students
	Importance of scaffolding and modelling for supporting student learning
	Make expectations on students clear and follow through

What we have learned from our participants is consistent with the literature on PSI, SDT and student learning support and congruent with our proposed approach. This approach is characterised by flexibility and individual support, by students and staff working closely together, by students driving their own learning. We have discovered no conceptual mismatches between this thinking and participant views. We have found that our approach should emphasize the elements of their jobs that our participants love.

The participants have provided many insights for the implementation of our proposal. These included ensuring adequate resourcing and setting up effective systems. There will be challenges in getting the structures right and in putting staff teams with the right mix of skills together. We will need effective systems to manage logistics, while at the same time ensuring human relations are in the foreground.

In terms of cautions, our participants made important points. A particular challenge could be around technological capabilities and resources. While ideally, we do not want to exclude anyone, we think that we have to insist on minimal requirements that may be higher than for many conventionally taught courses. For on-campus students this should not be an issue as universities provide the required facilities and the university can provide additional training required to master technologies. For off-campus students, we want to make it clear from the outset that participation requires video conferencing access.

5 Estimates of costs and staffing

Our approach to teaching and assessing first year courses builds on one-to-one conversations between students and staff. We expect every student to have several such conversations per course. In addition, we require staff time for more general support such as in lab situations or discussion forums. In the following sections, we build on various sources to calculate estimates of how many hours of staff time would be required to implement our approach. We compare these numbers to support figures from courses we are familiar with. We also estimate the financial impact of getting more students through to second year studies and how the income this generates for universities could be used to pay for increased support at first year.

In first year courses student numbers are relatively large. We provide our numbers for classes of 100 students and suggest that one can scale up more-or-less proportionally. We do not think that many first year courses would have substantially less than 100 students.

We treat on- and off-campus students the same in our estimates. An important aspect of our proposal is that we want to provide equivalent support to both cohorts. We are aware that there might be differences, e.g., it might initially take more time to establish communication channels with distance compared to on-campus students, yet we think that these differences will not be significant enough to affect our estimates.

5.1 Past and current support figures

In Section 2.1 ('Thinking about reviving PSI in 2018') we have reported indicative numbers for support:

- About 2.5 hours of teaching assistant support per student reported by Brook and Thomson (1982) for a PSI type first year statistics course.
- About 1 to 1.5 hours of casual support per student in first year courses in the mathematical and information sciences taught in traditional lecture-based formats at our university currently.

Those figures are calculated for semester long courses that are equivalent to an eighth of a student full-time load over one year. The staff employed are typically senior students (higher level undergraduate or postgraduates) who are paid on an hourly basis. At our university the payrates differ between tasks (e.g., marking, lab supervision) and student seniority and range between $17 and $21 per hour (inclusive of holiday pay). Assuming a pay rate of $19 per hour this relates to $1900 to $2850 per course of 100 students for our current courses and to $4,550 for the PSI type course (using today's hourly rates).

From personal conversations we are aware that of many first year courses at our university that receive stronger support. In a particular humanities first year course about 6 hours of support are allocated per student per semester. This time is spent on familiarisation of staff with the material, team conversations, tutorial work and marking. Staff are employed on part-time basis from before the semester starts to after the semester concludes. The individuals are on tutor or senior tutor contracts and typically support the same course for many years in a row. At our university the salary range for a tutor starts at about $50,000 per annum and finishes at about $90,000 for senior tutors. Taking the mid-point for our calculations and adding the overhead for ACC and KiwiSaver, we arrive at annual costs of about $73,000. Based on 250 as the average number of working days per year in New Zealand and a 7.5 hour working day, we calculate 1875 working hours per year at a cost of $39 per hour. Assuming again 100 students per course we arrive at $23,400 in support costs per course.

It is difficult to compare the support costs we have provided directly. For example, we do not have the total number of staff hours and staff profiles allocated to each course. In some of our mathematical and information sciences course most of the permanent staff are senior/tutors, in others the permanent staff are research-active academics. In the humanities course there is a research-active academic overseeing the work of a number of senior/tutors. The number of hours expected in supporting a course might be different across the staff groups. Still, we can see that our investment into supporting our mathematical and information sciences courses today is very low, not only in terms of numbers of hours allocated but also in using senior students on hourly contracts. We see the value of employing senior students. Some students in our courses might find it easier to relate to those more experienced peers than to staff with more formal titles. Our senior students not only gain from being paid but also develop their subject and interpersonal skills. Yet, senior students graduate and move on. Continuity is limited and there is little opportunity for developing knowledgeable and skilled support. For these reasons we advocate for employing senior/tutors to support our courses, comparable to the situation in the first year humanities course. Yet, it should be possible to involve senior students to a certain degree in in providing support, guided by senior/tutors and academic staff.

5.2 Estimates of support required to assist most students to pass

As established in the previous section, we base our calculations on the assumptions of employing senior/tutors at an hourly rate of $39 and at 100 students per class. As in earlier calculations, we do not factor in the workload required to 'run' the course in general but focus on the support and marking components.

We take a course that in conventional delivery takes one semester and has twelve teaching weeks followed by an exam period. We work on four learning objectives equalling four assessment points. In a traditional delivery these would be the assignments. For us, this means four learning objectives a student has to fully achieve to be able to move on to the final test. We do not consider the workload for marking the final test as we see this as largely equivalent to marking final exams in a traditional setup.

We work on three types of support: introductions and planning, casual support, and assessment conversations. As mentioned earlier, we make the same time allocations for both on- and off-campus students.

- Introductions and planning: We want our staff to meet with students early in the course to establish relationships, explain how the course works, and get the personal study plans started. We suggest these initial meetings are run in groups so students can meet peers. We allocate two meetings of 30 minutes per four students, adding up to 25 hours. In addition, we allow for one individual 30 minutes meeting per student to finalise their personal study plan. This results in 50 hours.
- Casual support: This is for ad hoc questions and conversations between students and staff that do not require specific appointments. This would be the equivalent of a tutorial, a supervised lab session or discussion forum support. We allocate two hours per week of study per twenty students. The number is based on the typical size of tutorial or lab groups. One hour per week is what traditional courses usually allocate; we have doubled this. The total number of hours depends on how many students stay in the course for how many weeks.
- Assessment conversations: With four assessment points we require at least four sessions per student. We allocate 30 minutes per session. This number is derived from the findings of our interviews. Appointments for undergraduate students are made for

30 minutes. We believe this should be sufficient, as in our context, relationship building already has started and the staff member is familiar with the material to be discussed. The total number of hours depends on how many assessment conversations each student requires.

To arrive at a total number of support hours required we estimate how fast our students might move through our course. We start with our strong students. Those students might only need eight study weeks and pass all assessment points in their first attempt. The next group of students might require 12 weeks and two assessment conversations per assessment point. We can continue this pattern by always allowing four more weeks and one more conversation per assessment point. Tables 2 and 3 show the figures we arrive at if we divide our cohort in groups of 20 students each.

Based on observations in our current courses we know that our strong students work through the material and the assessments without much help. Those students might finish the course early. The next group of students are the ones who get close to full marks the first time round (they would get an 8 or 9 out of 10 for our current assignments). With one round of feedback they should be able to achieve at the level required. Those students might need the full teaching weeks of the semester. As we go further, our students need more help and a higher number of support meetings. For Group III we estimate three conversations per assessment point and 16 study weeks. By working through the traditional in-semester break and using the exam preparation weeks following the teaching weeks those students should still be able to finish the course within the semester timeframe. Groups IV and V need more support again and will extend their studies beyond the semester. These are the students who in the conventional approach will either just scrape through or fail. We propose that it is better to work with those students over a longer time period to allow them to achieve a solid knowledge foundation.

Table 2: Estimated hours for student progress and support requirements (showing how many hours the teaching team needs to invest into support and assessment for 100 students based on their rate of progress within the semester)

	Group I	*Group II*	*Group III*	*Group IV*	*Group V*
# Students	20	20	20	20	20
Repeat factor for assessment conversations	1	2	3	4	5
# Study weeks to completion of all assessment points	8	12	16	20	24
Hours for casual support (2 hours per week per 20 students)	**16**	**24**	**32**	**40**	**48**
Total hours for casual support					***160***
# Assessment conversations (4 per student times repeat factor)	80	160	240	320	400
Hours for assessment conversations (30 minutes per conversation)	**40**	**80**	**120**	**160**	**200**

Total hours for assessment conversations	**600**

Table 3: Total estimated support time requirements for a course of 100 students

Type of support activity	Hours required
Introductions and planning group meetings	25
Planning individual meetings	50
Casual support	160
Assessment conversations	600
Total hours for class of 100 students	**835**
Total average hours of support per student	**8 hours 21 minutes**

On this basis, 835 hours of support will be required for a course of 100 students taught using our approach. Our recommendation would be to use senior/tutors to provide this support. At a payrate of $39 per hour this amounts to $32,565. Should we use a combination of senior students paid at a casual assistant rate of $19 per hour and senior/tutors, this amount could be reduced to $24,215 for a 50/50 split in support hours. Table 4 compares the support requirements across the different approaches we have looked at.

Table 4: Comparison across different teaching and support approaches

	Current math/info sciences course example	*1982 stats course example*	*Current humanities course example*	*Proposed CS/IT course*
Course and assessment design	Traditional	PSI	Traditional	Our approach
Requirements to pass course	50 % of marks available	Watered-down version of mastery	50 % of marks available	Achievement of all learning objectives
Typical pass rates	75 % *	?	?	Aiming at 90+ %
Type of staff	Casual assistants	Casual assistants	Senior/tutors	Senior/tutors 50/50 split **
Support hours per student	1.5 hours	2.5 hours	6 hours	8.4 hours
Costs per 100 students	$2,850	$4,550	$23,400	$32,565 $24,215 **

* *Average pass rate for first year CS/IT courses at Massey University 2014-2016*

** *Assuming a combination of casual assistants and senior/tutors at equal shares of support hours*

While the support costs for our approach are estimated to be substantially higher than the current investment into our courses, we need to set this in context to the level of knowledge gained by students and the pass rates. We have added some data to Table 4. In current courses students need to gain 50% of available marks to pass the course, typically split about evenly over course work and final exam. Achieving only 50 % means that students with substantial knowledge gaps pass the courses and move on to higher levels. There they are likely to struggle due to their weak foundations. Our approach demands that students achieve close to 100% of all learning objectives to pass the course. This means they move to the next level with far stronger foundations.

5.3 Estimates of increased income due to higher pass rates

Our estimates in the previous section assume that all students enrolled in the course remain committed to the course. This is an idealistic assumption but makes us err on the side of caution allocating more support hours than required. Our calculations show that we need $32,565 (or $24,215 if we also utilize senior students) to finance the support for a class of 100 students. We suggest that this is an up-front investment that could be recovered through increased pass rates and higher numbers of students advancing to second and third years of study.

To estimate the increased income to the university we use a 2 + 4 + 4 model. For example, to study for a bachelor's degree, majoring in Computer science (CS), a student needs to complete two CS courses at first year, then four at second and four at third year to fulfil the majoring requirements. This means that a student who passes the two first year courses based on our extended support, would now study eight more courses. The approximate income to the university gained per course in CS are $2,000 or $16,000 for the eight courses. This is based on the Student Achievement Component paid by the government to universities (TEC, 2018a) and the fees paid by domestic students. This means that if only four students (or three if we utilize senior students to provide half of the support) continued with their studies of computer science to second and third year, we would break even. (Figure 1). Should we be able to increase pass rates from 75% to 79% (or 78%) our increased support will have paid for itself. While more accurate financial modelling will be required, we hope to have demonstrated that there is a solid financial basis for our proposal.
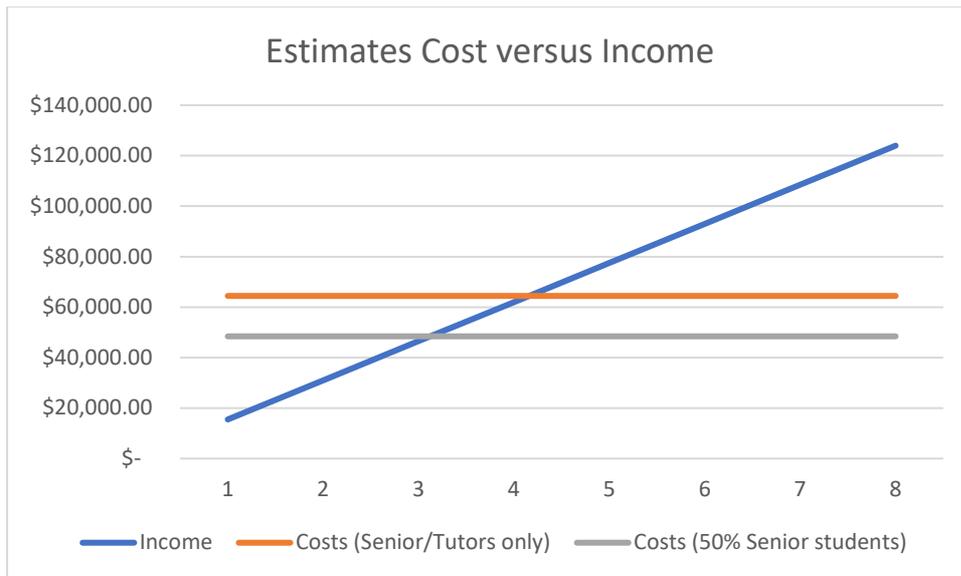
Figure 1: Comparison of potential costs and income for additional students taking 200- and 300-level courses.

5.4 Teaching team composition

We envisage the teaching team to be led by an academic who takes on the role of the course coordinator. The course coordinator is responsible for overseeing:

- Development of learning outcomes and objectives;
- Content selection;
- Creation of pre-recorded lecture, tutorial and exercise material;
- Definition of assessment rubrics;
- Creation of question banks for final tests;
- Coordination with general university study and learning support services;
- Coordination of the subject-specific support team;
- Finalising of grades.

We would also expect the course coordinator to be involved directly with the students and be supported by senior/tutors. The team would work closely together on all aspects of the course, exchange information frequently, reflect and adjust. We would ideally see several of the courses in a discipline area offered following our approach, with teaching teams supporting each other.

6. Conclusion and recommendations

We have presented a new proposal for teaching at first year university level that better adjusts to the individual strengths and weaknesses of students as they enter university. Our proposal builds on a large body of literature and strong evidence of effectiveness of the Personalised System of Instruction that was popular more than 50 years ago. Combining this with self-determination theory and our experience of effective educational practice we have sketched an outline for how such a proposal might be implemented.

We have sought feedback on our proposal from higher education teachers, and learning and writing consultants. Their feedback largely echoes the research reviewed and we have documented their endorsements, cautions and insights with respect to potential implementation. Key points included: concerns around deadlines and procrastination, ensuring opportunities for students to engage with peers, ensuring appropriate technologies are available and accessible and cautions around workload feasibility. How fast and how well a student progresses through the course should be determined not by administrative constraints but by the student themselves. Students at all levels of subject knowledge and learning skills at the start of the course should have a strong chance to pass the course and do so well.

Finally, we have presented some ball-park time and cost estimates for the proposal and demonstrated how these could be funded through concomitant increase in student progression rates. Appended to this report we include brief thoughts with regard to administration implications of our proposal (Appendix B) and tools and setup requirements (Appendix C). We trust that this information will provide a strong basis for first implementations. Many variations are possible and will depend on factors related to specific student cohorts, teachers, courses and institutions.

Fundamentally, the key recommendation from this report is to explore practical options to substantially increase the opportunity for meaningful pedagogic conversations between students and teachers; there is strong evidence from the literature that this approach works and there is clear support, albeit with some cautions and caveats, from staff we interviewed. While we have provided ballpark cost estimates, actual implementation costs can only be determined if one or more institutions are prepared to pilot such an approach with a limited number of courses but representing a broad cross-section of learners. The cost to pilot the approach should be well within discretionary budgets of individual institutions and we hope our argument will resonate with institutional leaders, managers and administrators who are seeking to improve both the transition to university and the first-year student experience.

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Appendices

Appendix A: Details on participants, interview analysis and discussion

Participants

Participants P3, P4, P5, P6 and P7 have discipline-specific teaching roles as lecturers or tutors. Three teach in the sciences, two in the humanities.

Participants P6, P8, P9, P10 and P11 all work in support roles for the university's central teaching and learning unit (participant P6 has a dual role). These roles include:

- Work at course level: Collaborating with academics in disciplines to provide course-specific support. For example, in writing and study skills tailored to the specific requirements of the course.
- Deliver workshops: Providing generic workshops to groups of students outside discipline-specific courses on topics such as study skills, referencing, essay writing etc.
- Provide one-to-one support: Providing individual students with personal support and feedback on skills such as academic writing, numeracy and study skills.

Most of the participants in support roles cover several areas in parallel or have done so in the past.

Most participants work with students across delivery modes, year levels, student origin (domestic/international) or ethnicity. One participant works for a Pasifika support unit.

Six participants are female; three are male. At the time of recruiting for our study, the university did not have a specific Māori support unit so none of our participants had support for Māori students as a formal part of their role.

Analysis

We summarise key findings under six main headings: Pre-course factors; course implementation factors (this section includes main comments specific to our mastery proposal); support systems for students; support systems for staff; student factors and staff factors.

Pre-course factors

Comments that students are ill-prepared, are in wrong courses or have a work load that is too high

Introductory level and transition courses are perceived as important for students who are academically marginal and at risk. And, early intervention is important to identify and help students who are struggling.

> P11: I think that kind of intervention [pathwaying, taster programmes; support on college level] early on is really, really important in ensuring that high risk students are identified early on in the piece and more target interventions are being put in place. Otherwise these students will just come, struggle and then fade away from the system.

One participant felt the university should have people assigned to contacting students who are performing poorly.

P8: I don't understand why there aren't people hired to directly contact these students if the school is concerned about them because I think that is what is needed.

Some participants felt students should not be at university as their English abilities are insufficient. These students may be International students without the required level of English as well as local students coming in from high school with low levels of English.

P8: I feel it's all very well to say we equip them with the skills but some students don't have the level of English to apply.

There will always be some students who are not well prepared for university studies.

P7: The statistical analysis that I'm doing under underlines the spectrum of ability that students are coming with from high school.

P11: I think the reality of it is that we do end up having some students that will not necessarily be at their best in terms of preparation for Uni.

There should be flexibility for distance students to be able to spread work over the year.

P7: If they were doing double semester courses, I would strongly encourage them to do maybe do 2 or 3 in a year because if they had a job, part-time or full-time job, there's no way that they could do a full or even possibly a half-time student load.

Work and family commitments are an important consideration in terms of planning the number of courses to take and managing study workload.

P9: There's work, sometimes there's children and other family members, or parents that need looking after. Things go wrong and things can get messy.

Course implementation factors

General assessment related comments

Three participants commented on formative assessment involving feedback on drafts and practice examination questions. The feedback concentrates on the rough draft. This allows consultants to spot problems early and help to put students on the right path.

P6: We are lucky in that we take in rough drafts and final drafts. With the first assignment, we really quickly skim over it and say, hey you have gone off-piste and here is what you should have been doing and then we do that for the second assignment.

P3: I spend more time giving comments on their rough drafts than I do on their finals. Because that's the formative.

One participant pointed out the issue with setting high-weight assessments early in a course without giving students any chance to understand step-by-step what is required and to learn from feedback.

P8: Their first assessment is worth 30% and it's just mean. There's no room for error. There's no room to learn from their mistakes.

Among learning and writing consultants there is a feedback system of higher, middle, and lower order concerns. This allows them to be clear on what aspects they want to target. Lower order concerns are things like punctuation, higher order concerns are skills like developing an argument. Consultants explain these concerns to their students. Typically, the emphasis is on higher order concerns. P6 explains:

> P6: The idea is that when you are giving feedback it's easy to do on the grammar and spelling but that's a lower order concern it's not going to affect the writing as a whole if the person doesn't understand the assignment. So, you need to force yourself to a higher level, that needs modelling a few times for the students.

Early engagement with assessment material prepares students for the types of questions they will face in exams.

> P9: You can have one whole session on exam prep because with exam prep there's 'the before', and 'the during', and the different sorts of things you can be doing as a student to prepare. So it about showing them what it can look like and providing actual examples of an exam paper.

Comments on plagiarism

Good course design can obviate opportunities for plagiarism. For example, students have to submit rough drafts and work on those in the classroom. There can be still cases where students try to circumvent the systems, but those are rare. Tools like Turnitin may be useful for picking up copying across campuses or tutor groups. Tutors know the levels students are at and notice work that does not fit.

> P3: Because the students submit work in the workshop you know what their level writing is and then if in their rough drafts they do something that's quite different, then you have alarm bells going off.

While there are only few formal referrals for plagiarism, one participant noted that students may come and see learning and writing consultant themselves if they realise that they have a problem from their Turnitin scores.

> P8: I had students send themselves though for plagiarism because they've had horrendous Turnitin numbers.

One participant pointed out that many first year students may simply be unaware of the issue and noted the importance of inculcating students into academic practice.

> P9: The vast majority of students who make that mistake of plagiarism in their first year, seriously just have no idea. So it's more the case of, what are we doing wrong as to why they are so oblivious?

Comments on course design

One participant teaching in a discipline, emphasised ensuring that laboratory components and tutorials are closely related to the lectures and making these linkages explicit to the students.

> P7: I say these tutorials will not be rehashed lectures; I've already given the lectures. [The tutorial] is where you work in small groups around these questions.

> P7: We work hard to synchronize our laboratory sessions with the lectures.

Obtaining consistency in messaging is an important feature of good course design.

> P10: All lecturers consistently referring to these instructions with the same name is obviously helpful for students. If this consistency is not there, and students don't know how to identify the instructions for the assignments, this can be unnecessarily problematic.

It can be difficult to design for a wide range of abilities, especially in first year. One participant commented on their own child becoming bored or disinterested in the material presented at first year.

> P5: A lot of it probably moved too slow for him and his buddies.

Comments about deadlines

In the experience of some learning and writing consultants, some lecturers may have unrealistic expectations about the timing of work and are not clear enough in communicating about deadlines.

> P5: One of the things that really bothers me is when I talk to my colleagues and they are like this two weeks of work, they have a quiz and that quiz is due two weeks from now. And I'm like but it was [over the previous work] here is more work in between. And they are like, yeah – they really should have it done but students don't get it done.

> P5: And I am like, how do they know when you have put a deadline two weeks later, how do they know that they were really meant to finish it?

The same participant indicated that she tries to be really clear in her communication about deadlines. She sets deadlines but is happy to extend those as long as students get in contact. The emphasis is on ensuring the students communicate with her.

> P5: And so I have been really clear with my deadlines but I am also super lenient, will give them any extensions they want if they will just contact me.

Comments related to learning technologies

A range of technologies are used to contact and connect with students: e.g. phone to contact students; emails or Google docs to engage them in a dialog where they demonstrate their writing or show images of their work; Skype or Adobe Connect for longer interactions and discussion.

The need to adjust to what facilities the students have and can operate was emphasised. For example, some students may not have a microphone. It may take a while to get the technical side of the communication going. Appointment time may need to be increased to allow for technical/setup issues. There is a need to make allowances for the first few sessions to be a bit messy as students and sometimes staff adjust to the systems used.

> P9: I often make online sessions in my calendar for an hour because I know that there may be difficulties just getting started, especially the first time.

But once established, technology mediated communication can be just as effective as face to face:

> P9: I have several online students now that I talk to regularly throughout the semester and they're just as interactive and effective as face-to-face sessions.

The same participant felt that while the opportunity to review student work prior to an appointment was helpful, they did not always have time to do this.

> P9: In an ideal world I get to see that before our session but often I don't. And that's just the reality of it, and often the first time I will see it is when I'm online with them and opening it for the first time.

There were a range of views about the mode of feedback: written, face-to-face, or comments using track-changes.

> P6: In person, you can go around and prod them what do you think? and force a bit more thought out of it.

Similarly, there were a range of views about face-to-face and distance courses and the role of technology in supporting them.

P11: We haven't really explored [the full potential of learning technologies in supporting the teaching and learning of Distance learning students]. I think Massey has invested a lot in technology but I don't think that we have been able to optimise on or taken advantage of the full benefit of technology.

Comments related to engagement

One participant follows up with distance students who have fallen behind via phone calls or emails. She tries to get them engaged and to the point where they are willing to show their work but explains that some of them are shy and protective.

P5: It's getting them to the point that they are willing to show me their work. So many of them can't, it's like that whole protective, I'm shy and I don't want to show what I don't know. So that is part of my whole ethic of care – creating this environment where they feel comfortable showing me what they don't know.

Another participant emphasised the importance of demonstrating the relevance of academic skills such as sharing and critiquing work.

P3: And another thing that I do is I always let them know as well, once you get higher up in academia, when you become a lecturer or a masters' student, post grad student, I let them know that the process is all about sharing your work.

Comments specific to the new Mastery Proposal

Face-to-face sessions with lecturers are likely to require active encouragement. This point was emphasised by the participant who worked with Pasifika students:

P11: It's nice when you have a first year student at the end of the first or second semester say 'oh yeah I'm talking to my Lecturer now'. It's just building the confidence to do that. So it's work in progress. You just need to keep on re-enforcing through the mentors or through me - students get to know your Lecturers, it's really, really important.

P11: That's one of the messages that we get our mentors to talk to our students at the beginning. "This is me when I started and this is me where I am now". Your Lecturer can either make or break your studies, it's important to build a really good relationship with your Lecturers. I haven't met a Lecturer who wants to fail a student – they are good people who want you do well, so the students need to recognise that. Make an effort, go talk to your Lecturer, don't just close your book and walk away.

Repeated conversations around assigned tasks and providing feedback on drafts are seen as important. This echoes more general comments about course implementation and assessment

P5: I think the mastery idea is so much a better idea because you are saying you really need to understand this stuff before you move on and it all does build on each other. It is putting the mechanism behind the words and saying this is important, you do need to face up.

Deadlines were emphasised by most participants as really important, also scaffolding and flexibility.

P6: Structure it, make them feel like they have deadlines, or that they have to get something in.

P5: The only other thing is that so many students just work to the deadline and so it is that lack of clear deadline.

> P11: I think this kind of approach, flexible delivery, accommodating students' different style and pace of learning, how they receive and interpret that information, I think there is a lot of merit in having this approach.

Deadline flexibility may be especially important for mature students who have outside commitments. One participant commented that deadline pressures can take away the enjoyment of learning.

> P9: When you enjoy your learning, you 'get it', in a way that your understanding and comprehension of the topic is profoundly felt.

There were generally positive reactions to the mastery approach with some caveats. e.g. One participant with experience of a STEM mastery course in the US noted:

> P5: Too many students were just trying to pass the test each time and not doing the learning – that was the problem. So the focus became the assessment instead of the work which I know for lots of students it is anyways – but ... acknowledging that those are really different things and that there is this process. So they put in where it had to get signed off as attending three sessions where they asked questions and showed their working before they could take the test part.

Another participant with experience of mastery tests in relation to low level writing skills, commented:

> P3: I can give you a bunch of different ways of thinking about where to put a possessive apostrophe, but unless you actually take ownership of understanding and knowing it, you are always going to put it in the wrong place, or it will be a hit and miss. So, it was good to have these mastery tests because that forced them to think about it.

> P3: I like the principles on what is proposed - the mastery learning idea and students learning at their own pace.

Staff resourcing could also present an issue. Some participants were aware or had experience of mastery programmes that had been tried and then stopped.

> P3: There was something that went on and you will have to talk to X about this. About why it wasn't working. Why they decided to let it go.

And others who were concerned about increasing workload from a mastery approach.

> P7: I kind of shudder at the workload implications.

Support systems for students

Who seeks help

A wide range of students seek help. No participant indicated any particular pattern in terms of ability or characteristics among students who seek support.

> P9: It's the students that really need help to students who are somewhere in the middle, to students who are excelling and want to keep excelling. Right across, definitely.

One participant, who teaches in a disciplinary area, provided an estimate of help-seeking among students in relation to course assignments:

> P4: Maybe a maximum of about 15 students out of 230 getting in touch with me specifically to say, hey I am thinking about question five and I don't quite get it, can you give me some advice. Or a query like that.

There was a consensus among participants that study support or writing support is only sought by a minority of students but one participant noted the importance of peer support.

> P3: [The bulk of students] they tended not to even use us … those middle ground ones, once they get talking to each other, that's a support system that they will use.

Duration and frequency of sessions

Learning and writing consultants schedule 30 minutes for undergraduates and 60 minutes for postgraduates. In practice, sessions vary from 5-10 minutes to well over an hour.

> P7: Some students it may only be 10 minutes, it may be a specific detail that they want elucidation around that and once they get it, you see the lights go on and they go yes, right I understand, thanks.

Frequency and duration varies widely. Sessions may be one-off or provide ongoing support, e.g. for writing development. Ongoing sessions may occur over a short period or extend over a full year.

Staff continuity is not emphasised in support services. Students with appointments to see writing or learning consultants may see different people on subsequent visits:

> P6: I know one of our main writing consultant gets, can I have [person X]. I don't think there's a right or wrong it's a pro and cons. And you let them or maybe you think she's busy that week so that's not the case.

Record-keeping for support sessions

There are currently no formal systems for recording the details of student support visits but some staff keep their own records.

> P9: Where I came from, where I previously worked there was a system for that. But here is purely optional and when I do make notes it's because I choose too.

One interviewee commented that even minimal record keeping feels a little intrusive

> P8: We have a spreadsheet where we say what course they were in and ideally their student number and their name, which I don't always get because it feels a tiny bit intrusive sometimes and it's also a bit much when it's just a drop in for a referencing issue.

Student support meeting structure and mode

Different modes of interaction are used for supporting distance students and different cohorts – e.g. Pasifika students:

> P11: … definitely the effective use of Adobe Connect and phone calls amongst other communication media are important in enhancing our support and improving students' experience…[but]…many Pasifika families have low internet connection, low laptop/PC ownership. It's a fallacy to make an assumption that because information is on websites they have access to that information because that's not necessarily the case.

And, there is a strong role for peer support.

> P3: It isn't just about the learning, it's about the peer support, it's about all these wonderful networks.

> P6: Get them knowing each other so they have a peer they are friends with. We go around the classroom.

In particular, when working with larger groups.

> P9: They become activities that are based around peers or group brainstorming activities and discussion, and then the students will feed back. If I can get them to come up and write on a whiteboard, then I will.

Support environments, relationships, and building trust

Relationship building, both at the start of a support session and for return sessions is important. Asking about what the student is studying and how they are experiencing their study is key before getting into the details of a specific assignment or issue.

> P9: Before we even get into the assignment that they want me to look at or work with them on, I ask them about them.

It is also important to take time to establish relationships. This may be harder in one-off sessions but is not impossible.

> P11: Conversations are really, really important…. I try and connect by talking about family, finding out about the student's experience and I think that's how I try to connect. Just talking with the person at a personal level.

> P5: So my philosophy is that I say I put in an ethic of care around it, I try to show them that I care who they are and how they are succeeding and I put a lot more structural things in there too.

One participant explained the concept and importance of creating a holding environment.

> P10: If a student is booked in at a certain time, I will be there at a certain time and how long it goes for – you make sure you stick to that time. There is a recognisable and fairly consistent structure in terms how one to one sessions are carried out and they know that anything in that space is safe. It's academically safe, it's emotionally safe; they are not going to be made to feel silly.

At least one participant noted that group settings may be more comfortable for some students.

> P6: The general setting students, due to the setting, are more confident and then you can check in with them, as a group, so it reaches more of them.

Even so, in group settings, students need to be comfortable with each other and feel that the environment is one where they feel safe to share.

> P3: Well one of the easiest ways to make them comfortable doing that, is if they know each other's names and can talk to each other. And to create relationships with each other, it's just vital.

> P3: Part of that class contract is a discussion about how we create an environment where people feel comfortable to share their work and how we respond to that work. And one of the things that I make clear is that we are here to help each other improve in writing. And this is not personal. And we keep anything that's personal out of it and we're just focusing on ways of improving writing.

Sometimes, students may just want a quick answer. At other times, more of a conversation is required to unpack particular concerns. So, the emphasis in terms of relationship building may vary.

> P8: They just need to get some advice with any faffing around.

> P8: Because some students want to have a little bit of a chat. Sometimes there's an element of counselling in what we do. Some students come in really upset.

Being clear about setting goals for support sessions is also key.

> P11: The one-to-one support can be most effective but it required the lecturer or staff to establish a good relationship with the student, it requires both to set clear goals have really clear expectations at the beginning of the programme.

And, it is important to recognise that actually speaking with a lecturer or seeking help requires a degree of confidence, especially for first year students.

> P11: It's nice when you have a first year student at the end of the first or second semester say "oh yeah I'm talking to my Lecturer now". It's just building the confidence to do that.

Finally, the right physical environment is important.

> P4: For example, in this building I came in and it is really cool – there is a space and there are all loads of students sitting there working on stuff.

> P11: These are held at the Fale Pasifika and it's important that we offer most of our services at a space where students feel comfortable with.

Students supporting each other

The role of peers in thinking about structuring support sessions has already been mentioned but peer support was a central theme that came through in all the interviews and extends well beyond formal structured sessions.

One participant, when commenting on the proposed mastery approach cautioned,

> P4: I would be concerned about the loss of students coming together; of being social in some area.

In a similar vein, another participant commented,

> P6: So anything you could do like a frequent study group or class that they could attend if they wanted to.

Creating an environment which facilitates students consulting each other is important since,

> P3: They might be too cool to come to me, but they will definitely go to each other.

Equally, some participants gave examples where group work or setting up peer group sessions did not work.

> P10: I think that failed now because it's just one of those things that can happen when trying to set up pairs of students - it's okay in theory but people don't turn up.

How to give help

Establishing an encouraging and supportive culture and using techniques like scaffolding and modelling all came through in the interviews.

> P8: I think that sort of thing, scaffolding assessments, is really important for first year students because I wonder just how many students are really upset and discouraged.

> P5: the number one difference between who will succeed and people who don't succeed is trying … . I do try to set up a culture where they will hopefully see that that [saying 'I don't know how to do that'] is okay.

However, even students who are committed may need help.

> P5: Even with these really committed people that come in here to pass and succeed, they are not passing and succeeding because they are not getting any of the help they need to do that.

It is also important to work out what the problem is. Another participant describes one strategy.

> P10: I do a thing where I go down a 'why' staircase – that's what I call it – where I want to get to the cause of why they are not doing well. If you just go in and start looking at an assignment or start working with their writing and making assumptions, you often won't get to the cause of what the issue is.

Once issues are identified, modelling can come into play

> P8: I'll model a paragraph or two but then they are expected to apply these changes themselves.

The overall approach to support is summarised by one of the participants.

> P10: What we do is catering to the students' needs after a needs analysis so what you are doing sounds similar in that you are not treating everyone as generic learners but giving them the opportunity to work as the learner that they are.

Academic vs. generic skill support (embedding skills)

There was strong support from all participants for embedding study skills training into disciplinary contexts.

> P8: I think an embedded service would be really smart ... fast-tracking to someone who is intimate with the assessments would really invaluable. I'm just appalled by how some of the Lecturers word their assignments. There is so much ambiguity and they often they are not clear instructions and they are not given examples and just having someone who has an understanding of what they are being asked to do would be really, really helpful for a lot of students.

> P4: I have writing consultants, I have members from the Centre for Teaching and Learning heavily embedded and involved in my first year course as part of a ... so one of the skills that I haven't mentioned is a writing one. And writing at a University level is a whole topic of enculturation in itself.

> P10: While students are learning their course, they are also learning best practice skills for how to learn ... if learning skills can be built in, it's a wonderful thing.

> P6: I think the more you can embed the more you can relate directly to what they are trying to, the more useful it is.

Resourcing for student support

One participant felt that the resource allocated to supporting students had declined.

> P4: I see what little support there is, I see that decreasing year on year.

Another expressed the same concern and also felt that resources were not necessarily applied where they were most needed.

> P8: I have had students say that the service is booked up over in the office proper, so I think we're a bit understaffed actually.

P8: I think it's [busier] partly because there's no-one available during the day. The Librarians tell me that students are coming in asking for the service and they're saying you'll have to come back in the evening.

Support systems for staff

Workload issues/workload planning

How many students are seen during the day varies according to the duration of appointments. Some participants described conducting as many as eight individual sessions in a day but the average is around four or five. Several participants commented on the intense nature of individual sessions.

P9: I always have the middle of the day when I have a student free hour. That's when I have my lunch and I don't have students booked in. I do other things. Otherwise it's quite intense.

P6: It's quite taxing meeting someone, trying to find out what's going on, looking at their writing, trying to understand their assignment and then doing the exact same thing right afterwards.

In relation to the mastery proposal one participant commented,

P3: I think if you do get into something where it is mastery, I think one of the things that really needs to be considered is what's going to be expected of tutors.

The same participant pointed out that it can be difficult to predict how long certain tasks will take and this can have workload and resource implications.

P3: If you're a diligent tutor, you just end up doing a lot of work for nothing.

Relationships and communication between discipline-based and support staff

Teamwork was seen as integral to providing support for students

P11: It's great to have a team where when you have a question or you have some difficulties in some certain areas, that you feel comfortable that you can just go and see a colleague.

And important that a range of skills are available within a team

P9: So it's good if you've got those skills in the team.

One participant stressed the importance of having good relationships between learning support staff and lecturers. In particular, for lecturers to inform students about the services available;

P10: When it comes from lecturers, students will listen.

One participant noted the cross-referrals support staff do when they encounter students with problems that are not academic.

P9: It's about having an eye for those things as well, not just on the academic but how is this student doing overall, are they coping? If they are sitting there crying, something is obviously wrong and that does happen.

Another noted the potential for students to get mixed messages due to a lack of communication with central support services and the course-based tutor team.

P3: So, we don't know if the advice that's being passed on, fits with what we are doing in our paper.

Student factors

Student responsibilities

Encouraging and allowing students to take responsibility was emphasised by some participants.

> P10: I've found that the more you can make it up to the student, the more the onus is on them, the more responsibility they are likely to take. It's a psychological thing, when we feel more in control of something or it's up to us and we are responsible for the consequences, then we are more likely to engage in that process.

The same participant, speaking about students under academic management or who are identified as at risk, noted,

> P10: If they come to us they'll often be okay. If they don't – they often won't.

Another participant lamented that some students do not put the effort in.

> P8: It's clear they have written it once and not read it again. I find that quite irksome actually, I struggle not to show my irritation there.

While noting that students need to do their part, another participant issued a caution in terms of assumptions.

> P11: University study is about independent learning. You assume, you make assumptions that students reach a certain point in time where they become independent, motivated learners but that's not necessarily the case for some students.

There was also some concern that meta-cognitive skills are not explicitly taught.

> P4: I am relying on their self-reflection which is not something that I teach, which is part of that enculturation bit. And this is something that there are many students who do not desire to do that and who just look at the mark and dump everything else.

Student self-belief

A range of views were expressed about the importance of students' self-belief and how to work with that.

> P4: You know, people sit there and look at a graph and say can you calculate the equation of the slope of its line and they will sit there and go I can't do this because I don't know maths. So that is perhaps one that most frequently comes up – is an absence of self-belief in maths.

> P10: I do see some of the other ones where students have got a bad self-belief through their writing. Their voice is very important. There's a lot of power to express yourself well through writing and to be able to gain that back [when there have been bad experiences in High School] is a fantastic thing for them. So in this role we can do that.

> P8: I have noticed there are a bunch of mature students who are doing a first year paper … they just read so much and understand so much and they are trying to fit it into the parameters of a first year assignment…They get really worked up because they can't fit all this thought into 1,000 words and I find that kind of trips them up…I actually would say the mature students, this would probably be something that trips up the mature students self-belief. Perhaps the younger ones don't have that much reflective ability.

Again, the importance of peer support is stressed as encouraging peer support can assist with self-belief.

> P6: We say at the start of the semester you are going to be looking at each other's work, some people are nervous, some might not feel they have a lot to offer.

Students are whole people with life issues

Life issues has been covered to some degree in the section on Pre-course considerations but several participants commented on factors outside of study that can impact a student's ability to succeed at any time.

> P9: Lives are so busy and messy, it's not just study usually. There's work, sometimes there's children and other family members, or parents that need looking after. Things go wrong and things can get messy.

In particular, distance students may be juggling competing demands.

> P7: I believed that the nature of the distance student's life, probably got a job, kids at home etc., it was really, really difficult for them to absorb the information in one semester.

Staff factors

Feelings and emotions regarding their work

Most participants expressed feelings of enjoyment and satisfaction when speaking about their roles.

> P4: I love my job.
>
> P9: Helping them get to where they need to be is just something that I've always been drawn to and I just love being in the roles like the one I'm in now.
>
> P3: Seeing that light bulb going on. It's just magic.
>
> P8: I have this one student whose writing has just developed amazingly and that's been very, very satisfying.
>
> P11: I'm in education because I have a passion. I enjoy what I do.

Most difficulties related to institutional, organisational or training issues

> P8: It's very clear that having a PhD doesn't make you a teacher. I think that's an issue that the University needs to think long and hard about. I don't get why you don't have a teaching qualification at university, it just doesn't make any sense to me.
>
> P3: … the stuff that I hate the most, is more to do with the institution. Tutors aren't valued here.
>
> P8: I'm just appalled by how some of the Lecturers word their assignments.

Comments on assumptions about student knowledge

At least one participant commented on assumptions made about student knowledge and academic skills.

> P4: There are lots of things that as lecturers we make assumption about that we just assume that students know how to do or will do and I feel that is a mistake.

Confidence in being able to do their job and to assess student skills and abilities

All participants came across as having confidence in their professional judgement and their ability to find a solution or work out an appropriate plan of action.

> P3: So, even if students, because we're a core paper, even if students, we think 'you're not even getting past that first hurdle' we need to try to figure out ways of helping them through.

Course work and draft essays or assignments help to provide a gauge as to student ability level.

> P3: ... that gives me a kind of like a heads-up about roughly where students are sitting

But, affective cues can also be helpful.

> P7: I think it's body language. And you can tell where a student might be saying yes, but their eyes are telling you they're not quite sure, they're not quite getting it. With others you can see where they might sigh, or they just relax or they just smile and their eyes light up. 'Now, I understand!'

> P8: My background is ESL so I think I've developed quite a good skill in reading comprehension on a student's face and I think just talking with them you know that they are going to be struggling.

Cultural competency

One participant specifically commented on the need for cultural competency in teachers in particular in relation to NZ's growing immigrant population.

> P11: New Zealand has a growing immigrant population and I think that's a cohort whose needs are not necessarily being met by any existing support.

> P11: Is there cultural competency amongst ... staff to cater for students at the level that students can relate to. So one of areas that [we] need to look at is building the cultural competencies of ... staff so that they are able or capable of engaging really effectively with not only Pasifika students but students from other minority ethnic groups.

Discussion of interview findings

We structure our discussions based on the six areas from our interview findings: pre-course factors; course implementation factors; support systems for students; support systems for staff; student factors and staff factors. In addition, we note further endorsements, cautions and insights derived from discussion during a seminar open to all Massey staff where we presented our findings. We set each area in context with our approach and extract endorsements, cautions and insights for implementation. Endorsements indicate where our planned approach provides a good fit with the practice of our participants. Cautions indicate where we might have to rethink, or take care with, our approach based on the experiences of our participants. The insights for implementation will help us with practical details.

Discussion of pre-course factors

Endorsements

Our participants confirm the wide range of abilities among students who enter university as well as their variety of commitments outside their university studies. We see this as support for our thinking that change is required.

None.

Insights for implementation

Our participants say how important it is to provide sound advice to prospective students to help them to choose the right courses and the right number of courses. Once students have started there should be early and proactive support. No assumptions should be made about how prepared a student is for University study; it is vital that expectations in relation to study skills are made explicit. For us, this means that an approach like ours cannot be implemented in isolation. It is essential to look at the bigger picture and work together with the university sections on course advice and support.

Discussion of course implementation factors

Endorsements

Our participants highlighted the importance of formative feedback in supporting student learning. Further, the assessment structure should allow students to learn from their mistakes without being punished in their grades. The participants also talked about matching the various parts of a course, e.g., lecture and exercise material. One participant explicitly talked about the potential of problems for students from going too slow. These comments match our approach well.

Course designs that ask students to show drafts of their work and provide the opportunity for early feedback prevent issues with plagiarism. Consistent with our participants' experiences, we do not expect plagiarism to be a problem for our approach. We will base our assessment around conversations with students on their work and will therefore develop an understanding of individual student work and capabilities.

Once working relationships with students are established, communication over distance mediated by video conferencing tools can be as effective as being in the same room. Therefore, our proposal does not distinguish between on-campus and off-campus students in regard to communication requirements.

Our participants see real potential for student learning in an approach based on achievement of learning objectives. They welcome an approach that treats students as individuals, asks students to take ownership of understanding and knowing, and puts power behind saying that course material is important.

Cautions

Our participants mentioned that not all students have access to all technologies (e.g., microphones). Our approach will rely on digital capabilities more than most other courses. In particular, being able to conduct online face-to-face conversations is essential to our approach for distance students. We will have to ensure that requirements are clearly communicated up-front and assistance is provided to students.

In terms of achievement of learning objectives, our participants voiced three cautions. These are: students focusing on deadlines, resource implications and learning for the test. We are aware of the potential links between a lack of deadlines and procrastination, which we plan to address by drawing on SDT. In Section 5 we address resource implications. Learning for the test should not be an issue for our approach as our in-semester assessments are not tests for which rehearsing of test options might help. Instead, students present work which is discussed with teaching staff.

Additional cautions raised during the seminar where we presented our findings included: dealing with repetition where different students struggle with the same or similar issues; potential issues with ESL (English as a second language) students who may struggle with oral communicative competence; and organisational issues. Covering the same ground with multiple students would certainly be taxing on staff providing feedback. Our approach to this is to take advantage of the flexibility our proposal affords. Where staff find similar issues cropping up, this advice should be communicated to all students. In this way, students who have yet to present for assessment can take advantage of the general feedback offered, while there is no penalty for those students who have already presented for feedback. Students with limited oral/aural communicative competence may find the approach challenging. Further consultation with ESL teachers and learning consultants is required to developed a strategy to manage this situation. Finally, organisational issues such as students waiting in line to have their work assessed should be largely avoided through appropriate use of contemporary scheduling and communication technologies.

Insights for implementation

It is important for the teaching teams to be clear on the aspects of learning they want to improve with their feedback. Further it is important to communicate course requirements well (our participants talked about deadlines) and for all staff involved to give consistent messages. These points directly translate to recommendations for our approach in working towards good team preparation, clear criteria for assessment conversations, and excellent communication to students. Importantly, feed-back loops built into our course design, which stem from conversations between students and staff, provide for a responsive and adaptable learning environment.

Our participants pointed to the wide range of technologies used to interact with students and to the willingness of staff to adopt student tool choices. Our plans see us being more prescriptive. In particular, we regard face-to-face conversations as essential for establishing the necessary communication channels. Just using phones or email will not be sufficient. This means that we will have to ensure that our distance students have equipment and knowledge required to conduct online face-to-face conversations with us. We regard those face-to-face conversations, technology-enabled or in-person, as essential to build relationships. A key goal is to get students to the point where they are comfortable to discuss their work. As our participants say, the ability to talk about their work and to have the confidence to approach teaching staff is crucial and can take time to develop.

In the discussions about achievement of learning objectives it was pointed out that students should be provided with a structure that makes them feel that there are deadlines. This is why we propose to ask students to develop personal study plans. Students set themselves deadlines and are supported to develop the skills and attitudes required to meet them. As SDT states, students are more likely to adhere to deadlines they have determined themselves and been supported to work towards, than to an externally enforced schedule.

Discussion of support systems for students

Endorsements

Our participants were clear in saying that only a small proportion of students seek help and that it is not possible to pinpoint who will. They talk to students who really need help, to students in the middle and to students who excel. These observations match our belief that all students benefit from focussed conversations with staff. Our proposal requires that staff talk to every student. At the minimum, our conversations will focus on the achievement of

learning objectives. This will naturally involve giving formative feedback to students who are not yet at the right level. Our hope is that establishing contact with staff early in the course and providing a safe and supportive environment will normalise and promote further help-seeking by students. We hope to offer something to every student by adjusting our responses to individual needs, for example by helping stronger students to extend their knowledge and by appropriately scaffolding tasks for weaker students.

Students need environments in which they feel comfortable to spend time and work. This is consistent with the learning spaces already on offer to on-campus students. We hope to extend similar virtual spaces to our off-campus cohorts.

Cautions

While technologies like video conferencing are welcome in terms of opening up communication, there is a warning about levels of access for some students with poor internet connections or lack of suitable devices. As our approach depends on tools like video conferencing, participating could pose a problem for such students. At this stage, we are not willing to lower our requirements as we regard face-to-face conversations as essential to the success of our approach. However, course requirements will need to be very clear and our hope is that the expanding reach of wireless and broadband services and increasing availability of public and free spaces for computer use and internet access (e.g. public libraries) will continue and resolve these issues.

Participants cautioned that that there should still be extensive opportunity for students to interact and work together. This may be harder to achieve than with conventional teaching approaches. Changing lectures from regular to infrequent events and by encouraging students to follow their own study plans there will be fewer occasions where students get together in one room and might communicate with each other. We acknowledge this point and hope to be able to address it. By normalising discussion of course material with staff and peers and by removing competition among students for grades in internal assessments, we hope to create an environment in which students seek contact with their peers. This is to be supported by offering comfortable physical and effective virtual workspaces with supporting staff nearby.

Insights for implementation

Our participants report a wide variety in consultation session length and frequency. Some support sessions are one-offs, some students make several repeat visits. Our context will be different as support will be linked directly to a specific course and not a general university service. Yet, what we can take away for our implementation is a need for flexibility. Outside our scheduled assessment conversations, we need to offer opportunities for students to engage with staff in a flexible way.

Our participants do not have access to a formal system for keeping records of their conversations with students. Some make their own personal notes. In our approach, we envisage two situations where records will be important. These are the personal study plans and the marking rubrics associated with learning objectives. In each case, notes will be shared between student and staff. There may be other things that we need to track, yet, we will need to keep in mind that it could be intrusive to record every support detail. This is important, as we are trying to create a co-operative and trusting environment in which students feel comfortable to ask and share issues.

Participants pointed out how important it is to build relationships with students. This includes talking about the students' study context but also their personal circumstances. Establishing a certain level of comfort and trust, an academically and emotionally safe space, is necessary

before working out what type of help students need. With personal study plans and repeated conversations around achievement of learning objectives, our approach should provide conditions supportive of relationship building and personal context. Even so, we will need to work with staff to structure conversations appropriately and facilitate the right atmosphere. We need to consider if targeted support teams, where a student always talks to the same staff member, or more flexibility, to widen students' perspectives, is preferable. Resource requirements will also be a consideration in this respect. We should certainly kickstart relationship building by conducting getting-to-know-you meetings early in the course.

Scaffolding and modelling are important tools to support student learning. We will need to ensure that our staff use these tools in their conversations with students. We also need to consider this in design and implementing our courses. A good example is provided by Rae (1993) who used video technology to capture demonstrations of problem solving. This is readily done today with modern technologies. We can follow Rae's example of not releasing sample solutions but encouraging students to work through the demonstrations or posing Parson's problems[2] as alternatives.

Besides describing an overall decline in resources available to support students, participants expressed concern about providing support at the right time. This will also be a challenge for our approach. We will need to offer suitable times for booked appointments but also cover ad-hoc support. For bookings we probably can offer blocks of time where it should be possible to accommodate all student needs. For ad-hoc support we might have to restrict ourselves to key hours in the day, e.g., from 10-12 noon for on-campus and from 7-9 pm in our virtual offerings. It will help if we can find staff who can cover multiple courses, e.g., all computer science and information technology first year courses offered concurrently.

We also need to think about if and how we integrate support for generic study skills. An embedded approach was favoured by our participants. For example, learning consultants might work with students in the creation of their personal study plans or teachers might work with learning consultants to incorporate and scaffold study plan creation as part of the course. In an embedded model, learning consultants would be involved in teaching aspects of the course.

Discussion of support systems for staff

Endorsements

None.

Cautions

It is difficult to predict how long certain tasks are going to take. Many staff put student needs first and burnout and doing unpaid work are potential risks. This could certainly be a factor for our approach. We can estimate how many rounds of support a student will need before achieving a learning objective but estimates may be incorrect. We will need to gather data over several rounds of implementation to have confidence in our estimates. We will also have to put safeguards into place to protect our staff resources. For example, while we do not want to set limits on the number of assessment conversations a student can ask for on the path to

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[2] Parson's problems involve providing students with lines of syntactically correct code and asking them to place the code in the correct order in order to achieve a specific goal and test conceptual understanding. Introduced by Dale Parsons and Pat Haden in 2006 as a series of interactive programming puzzles (Parsons & Haden, 2006), there has been considerable research into the approach by computer science educators since. Correlations have been found in student performance between Parson's problem solving and code-writing (e.g. Denny, Luxton-Rily & Simon, 2008).

achieving a learning objective, we can implement some ground rules that balance support with independent student learning. This might mean that we set minimum periods between assessment appointments. These periods can be used by students to work through feedback provided and make progress towards the learning objective before a follow-up meeting.

Insights for implementation

Our participants reported having as many as eight sessions with individual students per day, with the average being around four or five. Meetings require full concentration and conducting several meetings in a row can be quite demanding. This point was emphasised during discussion in the seminar where we presented our findings. It is particularly true in the context of our participants in general support roles, who in a single session may be meeting a student for the first time, have to form a relationship with them, and ascertain the study context before engaging with the student's work. The situation should be less onerous with our approach. Our staff will have the opportunity to build relationships with students and will be very familiar with their study tasks. Still, our staff will have to familiarise themselves with the individual student work on the spot and will have to work out how to best support the student's learning. We will need to plan carefully, observe what staff loads are possible and continually evaluate how best to structure staff working days, in close consultation with staff.

A team approach to student support was recommended. The primary focus in our implementation will be using staff with domain knowledge for assessment conversations and student support but they will be supported by study skills specialists or learning consultants. In partnership with learning consultants, ideally, we will integrate study-skills, including developing personal study plans, and learning support into our course design.

Discussion of student factors

Endorsements

Our participants made a number of observations that fit well with our approach. Students need time to adjust to university study. This can be in terms of learning skills, such as independent learning or reflection, or gaining academic confidence; developing their own 'voice' in written work or developing mathematical maturity and skill. Interestingly, it was noted that some mature students entering university overestimate what is required for a first year assignment and may need guidance to not go beyond requirements. Our approach serves these needs well with individual attention to students and flexible timeframes that provide the time and space to adjust. This flexibility also caters for the different life circumstances of students, that at times demand their attention.

Consistent with SDT, it was recommended that students should be encouraged and allowed to take responsibility for their learning. The more students feel in control the more they are likely to engage. This mirrors our thinking.

Cautions

One voice of caution talked about the assumptions some university staff make by thinking that students eventually will become independent, motivated learners. Our approach requires a higher level of self-direction from our learners than conventional courses. External deadlines and conventional assessment may allow students to slip through with partial knowledge. Nonetheless, it is likely that not all students who start our courses will pass. Some will not develop the self-direction required, some might not master the material to the level required.

Insights for implementation

Participants mentioned that some students do not put the required effort into their work. The example provided was of written work that the student obviously not proof-read before presenting. The staff member found it difficult to invest their effort under those circumstances where the student had not done their part. For our approach we need to develop a system that makes it clear that we are willing to support our students, but at the same time expect that students do their best before, while and after seeking our help. This could be an issue to manage for our scheduled assessment conversations. We want to use our resources effectively to assist student learning. Spending 30 minutes to look at underprepared work or seeing a student again who has not engaged with feedback given previously will not be appreciated by staff. It will be important that expectations are unambiguously communicated to students

Discussion of staff factors

Endorsements

Passion, enjoyment and satisfaction in supporting student learning were dominant emotions among our participants. Moments of seeing a 'light bulb switch on' in a student's mind or looking at a much improved piece of student work are what drives our participants to invest so highly in their jobs. Downsides are related to institutional issues, which include having to interact with academic staff who are not as well prepared as they should be and the low appreciation for tutors in universities. While these downsides are beyond the scope of our project, we hope to strengthen the elements of teaching that provide the most satisfaction to staff. Direct contact with students and comprehensive individual support are at the core of our approach. We will work hard to ensure our courses are properly resourced and provide room for staff to guide students through their learning journeys.

Our participants felt comfortable in assessing student skills and abilities. They draw on samples of students work, and their interactions with students to gain an understanding of student knowledge and skill level, and to identify gaps. The participants were also confident in their ability to help students to improve. This is congruent with our approach that relies on our staff identifying student needs and providing appropriate guidance.

Cautions

This is something we will need to address in order to work with our students in culturally appropriate ways.

Insights for implementation

None.

Appendix B: Investigation of administrative implications

A key component of our proposal is that students progress at their own pace. This is essential to provide weaker students with the time they require to learn from feedback and develop their knowledge and skills, and stronger students to work at the speed they are capable of. This prompts on investigation into potential constraints.

University-external implications

An internal feasibility study conducted by Massey University in 2017 concluded that neither the Tertiary Education Commission (TEC) nor other external agencies pose constraints to implementing a flexible approach to course design.

- TEC states that one credit is equivalent to 10 hours of study, implying that a 15 credit course requires 150 hours of study. Yet, there is no link between hours of study and course duration. This means that there is no issue with a student finishing a 15 credit course in a shorter or longer period that the length of a standard semester.
- The CUAP process should pose no implications on the flexible approach for the credit value of a course. Courses are already offered across a variety of timeframes (e.g., single standard semester, double semester, summer semester). The key consideration is not the length in calendar months but the number of study hours a course is designed for. The Student Achievement Component (SAC) of funding should also not be affected as a student still completes the course as designed for a specific number of study hours.
- By withdrawing from a course, a student could become part-time, potentially affecting their StudyLink entitlements. The 'Academic Best Interest' regulation allows the university to declare that a student is a full time student, even if the student studies fewer courses than ordinarily required (https://www.studylink.govt.nz/about-studylink/glossary/academic-best-interest.html).

University-internal administrative implications

While the feasibility study concluded that no constraints are posed by TEC or other external agencies, changes to internal university procedures will be required.

- Universities currently set tight timelines for students to withdraw from courses. Those timelines have to be reviewed to allow for the flexibility our approach requires.
- TEC requires that a course has start and end dates. Results for a course (the Single Data Return, SDR) must be filed in the year in which the course concludes. Our approach potentially requires shifting student enrolments into a new course delivery to be able to delay the filing of results.
- Current procedures for finalising course completions rely on an examination committee to finalises grades. This examination committee needs to sit more frequently or delegate responsibility so students who have completed all course requirements can get a grade and officially complete the course outside standard end-of-semester times.

University-internal course completion implications

First year courses in mathematical and information sciences typically have invigilated exams as part of their assessment. Such exams take place at specific dates and times and are held at dedicated exam venues where invigilators supervise students. Our approach does not fit this traditional schema as our students need to be able to sit their final assessment when they are

ready. We therefore cannot comply with everyone taking the exam at the same time and the traditional monitoring procedures with secured rooms and invigilators will not work with our approach.

A possible response would be to not hold a final exam and rely purely on the course internal assessment. Such approach is already practiced in disciplines outside the mathematical and information sciences. Yet, we see value in a final assessment item that focuses on integration of knowledge across all learning objectives. We want this to be a summative assessment item that gives students the opportunity to showcase their excellence at the end of their learning journey. There are several other possibilities for setting up our final assessment item.

- One option would be to use written test (multiple choice and short answer items) administered via the LMS. We would need to establish procedures to ensure the equivalence of questions and marking. Remote proctoring systems could substitute the in-room invigilation.
- Another option would be to move away from written answers but require audio or video recordings. LMS already allow for test questions that request a recorded answer. As our students will be well versed in talking about the course material, this could be a real option. As our staff would know our students quite well at the end of a course, they could easily verify if the right person has provided an answer.

Appendix C: Thoughts on tools and setups

In this section we explore in more detail how our proposed approach could be implemented. We draw on the literature already examined, on our interviewees and on our own experiences as teachers and researchers of technology-supported teaching and learning and higher education.

Marks and grades

We suggest a 50/50 split between course work and a test that concludes a course. The course work is structured around the learning objectives. In total, 50 marks are available for these learning objectives. We suggest three to five learning objectives. For example, there could be a smaller introductory learning objective worth 5 marks, followed by four learning objectives worth 15 marks each. To pass the course a student has to achieve all learning objectives fully. Multiple attempts are allowed for each learning objective to enable students to achieve this goal. The sequencing of learning objectives will be decided by the teaching team. For some courses a linear sequence might be the best, for other courses in might be possible to work on learning objectives in parallel. Once a student has achieved all learning objectives they have 50 marks and are guaranteed a C grade.

Having achieved all learning objectives a student can sit the test. This is a summative test that can only be taken once per course. 50 marks are available and the student's mark is added to the 50 marks from the internal assessment. This allows the student to improve their grade. A poor performance in the test will not cause the student to fail the course as the C grade is already achieved. It will not be compulsory for a student to take the final test. The same grade distributions as used for traditional courses can apply.

Tools for study plans

We have outlined the importance of personal study plans. We see the study plans as being owned by the individual students and developed by the students with assistance from staff. The study plans will be living documents, adjusted throughout the course. While there might be one dedicated staff member who works with a student on their plan, all members of the teaching team should have access.

There are a number of parameters for consideration: Are study plans course specific or do they cover several/all courses a student takes; do staff have read-only or also write access; how are document versions preserved; which specific tools (calendar, graphs) are required? While a specialised planning tool or LMS component could be developed at a later stage, we suggest to start with generic tools already available.

- Word processing programme: Document review functions enable feedback provision. A cloud storage version, e.g., Google Docs, facilitates access by student and teaching staff. Students will already be familiar with the functionalities.
- ePortfolio system: As ePortfolio systems are designed towards reflection and formative feedback this would set the right tone for work on the study plan. A potential downside could be that students are not already familiar with ePortfolio systems.
- LMS components: The settings of either assignment tools and wikis could potentially be adjusted for study planning. Working within a course environment in the LMS would have the advantage of keeping plan and other course activities close together but would make the sharing across courses less natural.

Procedures and tools for bookkeeping and appointments

Due to its flexibility our approach requires procedures and tools.

- Scheduling of support and assessment conversations: This can be a calendar tool that shows staff availability and allows students to book sessions. Guidelines need to be developed and shared with staff and students to set parameters. For example, staff should be able to state a 'stand down' period between assessment conversations to ensure that students take time to work through feedback provided instead of relying too much on staff for help.
- Support for assessment conversations: In preparation for an assessment conversation, students will solve a number of tasks. The respective documents need to be accessible to the staff member during the assessment conversation (via the LMS or an ePortfolio system). The outcomes of the assessment conversation can be captured via LMS assignment tool, supported by a marking rubric.
- Signing up for end-of-course tests: Students who have achieved all learning objectives can book in for a test. Tests can be available anytime or might be offered weekly.

Communication channels and tools

Communication between students and staff but also among student peers is at the heart of our concept. We need to cater for communication within the same physical environment and via distance.

- On-campus students: We envisage a comfortable study environment where students can feel at home. This should be a space with comfortable seating, could heating, light and ventilation. Some computers can be provided, yet we assume that most students will bring their own devices. We see this as a space for self-study, for conversations with peers but also for impromptu mini tutorials. Teaching staff should be located close by and should, at key hours, be available to students. For on-campus assessment conversations there need to be private rooms near-by. Those rooms could also be used for the initial small group meetings that start off the course.
- Off-campus students: We regard face-to-face conversations as essential. A variety of desktop video conferencing tools are available and it should be possible to select a suitable tool that is easy to use and has features such as desktop sharing (required to support the discussion of student work). As our distance students are likely to live in a variety of time zones and have commitments outside study we will need to offer a range of timeframes for conversations. Our initial group conversations will help students to get to know some peers and might form the basis for student-initiated study groups.
- Connecting on- and off-campus students: We suggest experimentation with open video connections. Monitors with live video conferencing sessions are placed into the physical study areas. This way distance students could 'pop by' and join in a conversation or start a conversation with a staff member. We think that starting the course with group-based video conversations, in which students not just passively listen but are seen and speak, might help to overcome initial shyness in participating.
- Connecting self-paced students: We assume class sizes of at least 100 students. With three to five learning objectives, sizeable groups of students working on the same course material at any one time. Discussion forums specific to learning objectives can connect students working on specific course sections.

Feature talks

Our approach removes in-classroom live lectures and replaces them with pre-recorded material. With feature talks we want to capture the best of what a lecture can offer – an enthusiastic academic talking from the depth of their knowledge about their discipline. Feature talks could be scheduled every four weeks for live on-campus presentation and be recorded for distance students. The material presented should be related to the course objectives, at a level that is accessible to a first year student, but also containing concepts and ideas that extend their knowledge. The material would be an add-on, not essential for passing the course. Not being limited by assessment requirements would give the freedom to select interesting topics, link to research and engage the audience in explorations of the discipline. One could make the feature talks a departmental event, attended by all staff and first year or in general undergraduate students. A social component based around simple catering could be added and continue the building of connections started in the flexible first year courses. Feature talks will be important to capture the traditional university model of exciting lectures while reducing the negatives of boring content transmission and routines.