Unexpected Student Behaviour and Learning Opportunities: Using the Theory of Planned Behaviour to Analyse a Critical Incident

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***Abstract*—One of the challenges in being a teacher is to set up an educational setting where the students receive relevant learning opportunities for the specific course, the students' education in general, and for their future. However, efforts to create such educational settings do not always work in the way that faculty has intended. In this paper we investigate one such effort seen from a critical incident perspective. Central to the analysis in this paper is how the Theory of Planned Behaviour (TPB) can provide explanations for the incident. The critical incident can be summarised as students refusing to take part in a non-compulsory, but from the faculty perspective highly educational, activity. We describe the incident in depth, give the background for the educational intervention, and analyse the incident from the perspective of TPB. This paper makes two major contributions to engineering education research. The first is the development of a method for analysing critical teaching and learning incidents using the TPB. The critical incident analysis illustrates how the method is used to analyse and reason about the students' behaviour. Another contribution is the development of a range of insights which deal with challenges raised by learning interventions, especially those involved with acquiring hidden or "invisible skills" not usually seen or acknowledged by students to belong to core subject area of a degree program.**

I. Introduction

One of the challenges in being a teacher is to set up an educational setting where the students receive relevant learning opportunities for the specific course, the students' education in general, and for their future. It is especially challenging to create learning environments involved with acquiring hidden or "invisible skills" (defined by for example [1]) not usually seen or acknowledged by students to belong to the core subject area of a degree program. Moreover, efforts to create such learning opportunities do not always work in the way that faculty has intended. One example of such an effort is described by Peters et al. [2] where a critical incident reveals that many students taking a project course aimed at preparing them for being global software engineers do not see the value of the course as it clashes with their perception of being software engineers, and are hence not motivated to put effort into the course. The critical incident presented in the paper by Peters is within the context of an Open Ended Group Project educational setting, which aims at developing professional skills relevant for software engineering. In a paper by [3], the evolving use of this learning environment is presented together with the challenges it has faced. Other related studies have investigated the effects of educational settings called service-learning which combines community service with instruction and student reflection [4]. In the book by [5] such learning environments are explored and challenges and solutions are presented in relation to community service as a part of teaching in learning in higher education.

A number of studies have investigated the effects of teacher and student motivation on behaviours and the quality of student experience and performance. For example, [6] establishes that students' interest in the topic and achievement motivation predict both their experience of the learning situation and their achievement, independently of their ability. [7] show that students that are motivated to process the learning material perform better than less motivated students, regardless of clarity of instructions. [8] investigates how teachers' enthusiasm correlates to choice of instructional methods and students' perception of the learning situation. [9] developed a model where teacher interest is described as consisting of subject, didactic and educational interest. The model is then used to investigate the effects on student motivation [10]. The study finds that teachers' educational interest is a strong predictor of classroom management, which in turn shows strong effects on student motivation.

Inspired by a similar, very successful course at another university, a course in human-computer interaction was re-designed with an element of gamification [11] as well as presentations in front of a jury. Such elements are known to increase motivation in a very similar setting. The teachers planned the course based on the rationales presented above to create a more student-centric learning environment. To their surprise, many students seemed not to be motivated to engage in the setting, and the gamification component in particular did not seem to have a positive effect on motivation. As such, the learning activities introduced by the teachers had not the

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outcome they expected. We will describe this in terms of a critical incident and use the Theory of Planned Behaviour to analyze the incident. The focus is on understanding the gap in alignment between the teachers' intentions regarding student activities and the students' actual behaviour.

This paper addresses the following research questions:

- Q1: Which differences and similarities between the intended behaviour (by teachers) and the actual student behaviour can be identified in the particular critical incident?
- Q2: How can the Theory of Planned Behaviour be used when analysing and understanding the critical incident?

Understanding the student behaviour in the context of a particular incident is the focus of this paper, but the methods applied in the analysis can inform the analysis of incidents and educational settings more generally. One key contribution of this paper is to investigate the application of the theory of planned behaviour (TPB) to yield insights into factors that contribute to understanding student behaviour in teaching and learning settings in higher education. This is particularly relevant for studies in higher education where a much higher degree of learner autonomy is expected of all students, in comparison to the more tightly controlled environment typical of K-12 education.

In the paper we will first give a theoretical background by giving a summary of the Theory of Planned Behaviour (TPB) and briefly mention some aspects of the Critical Incident Analysis. This is followed by a description of the context, i.e. the course and the intentions behind changes, for the critical incident being studied. We continue by presenting the method used and some aspects of the data collected and a description. The actual incident is then described before we use the proposed method to analyse the event and trace reasons behind student behaviour using the TPB. This is followed by a discussion of the method and the results.

II. Theory of Planned Behaviour

The Learning Sciences have a long history of re-deploying models from the wider social sciences to describe aspects of educational theory. Thus, for example, Tinto's model of student retention [12] is based on Durkheim's model of Suicide [13], while models of classroom management [14] have been based on self-actualisation theory [15].

Social Psychology models have, historically, started their analysis of behaviour by considering attitudes as important predictors of behaviour, although the relationship may well be an indirect one. The main approach has been to develop integrated models of behaviour which account for the variation in observed action, while controlling for sociodemographic factors. Of these models, those based on social cognitive theory [16] have received a great deal of interest and they now constitute some of the most frequently used models of human behaviour employed in behavioural change research [17] [18]. They have been applied to such diverse fields as health-related behaviours [19], criminology [20] and education, where they form the basis of the Technology Acceptance Model (TAM) [21]. This has resulted in the inclusion of additional determinants such as social norms or intentions which mediate the effects of attitude on behaviour.

An early example of such a social cognitive theory is the Theory of Reasoned Action developed by [22]. This sought to model volitional behaviour and proposed that intentions to perform a particular act are predicted by two variables: attitudes, which reflect a person's evaluation of his/her behaviour performance, and subjective norms, which reflect a person's perceptions of important others' approval for behaviour performance, and the person's perceived level of behavioural control. Hence, rather than attitudes being related directly to action, they serve rather to direct behaviour by influencing the intentions of the agent. In addition to personal attitudes, subjective norms, that is, an individual's perceptions of general social pressure to perform or not to perform the behaviour also contributes to intention. If individuals perceive that other individuals who they deem significant either endorse or disapprove of the behaviour, they are more or less likely to intend to perform it. In general, the more favourable the attitude towards the behaviour, the stronger should be the individuals intention to perform it.

This theory was relatively successful in accounting for behaviour which was dependent solely on personal agency, i.e. the ability of the subject to form an intention about a desired course of action and to be in a position to follow that through. However, it was less successful in accounting for behaviour in which lack of control over the implementation of the action was a significant factor.

The Theory of Planned Behaviour [23] sought to address this by positing that a person's plan or intention to act is indeed the primary predictor of subsequent behaviour and that personal attitude and social pressures and norms are determinants for an intention to act. Nevertheless, another significant contributory factor to intention is a person's perceived behavioural control, i.e. the extent to which they perceive they can control their behavioural performance. Perceived behavioural control influences both intention and behaviour and was introduced to allow the prediction of behaviours that were not under complete volitional control, i.e. the formation of an intention to do something was not sufficient to ensure that the action would follow since individuals perceive there are constraints which restrict their degree of choice and their ability to perform the action.

The inputs into attitudes, subjective norms and perceived behavioural controls are beliefs which link a given behaviour to a certain outcome, or some related attribute such as the cost of performing that behaviour. An individual may possess a large number of beliefs about a particular behaviour, but only those which are salient at a particular time will affect the outcome. Attitudes are underpinned by behavioural beliefs, subjective norms by normative beliefs and perceived behavioural controls by control beliefs. Each behavioural belief consists of two components: a belief about the likelihood of an outcome occurring and an evaluation which weights the importance of that outcome. Normative beliefs again consist

of two components: referent beliefs, i.e. the set of beliefs held by those who the subject refers to for guidance, and motivation to comply. The second component again moderates the first, because one is only likely to experience social pressure from particular referents if one is motivated to comply with those particular referents, i.e. those persons or external influences that are considered significant by the individual in the situation. Finally, the theory proposed that the beliefs underpinning perceived behavioural control are the perceived frequency of those factors that facilitate or inhibit the actions in question. These too are moderated by the relative power of those factors to inhibit/facilitate that behaviour. In all cases, the saliency or relevance of the beliefs to an individual promote or inhibit the corresponding factors.

The Theory of Planned Behaviour, as outlined above, has proved very appealing to researchers working in the field of behavioural change with meta-analyses reporting explanatory effects of 20% of the variance in prospective measures of objective reporting of behaviour, i.e. a medium to large effect size [24]. Nevertheless, there are questions about the extent of its scope within social psychology and its application to other domain areas [19]. Some researchers have speculated that the theory can be incorporated into a Dual Process Model in which behaviours arise in two different ways. Where motivation and opportunity permit, intentions may well mediate the influence of attitudes on behaviour. Alternatively, when either motivation or opportunity is lacking, the attitude toward the object may impact on behaviour in a more spontaneous manner, e.g. as described in the MODE model of [25]. In addition, [26] suggest that two additional variables have been shown to independently contribute to the prediction of intention, in addition to those mentioned above. The first of these is social identity which refers to that part of an actor's self which relates behaviour to societal goals and reflects the extent to which individuals see themselves as fulfilling a role within society. The second factor is a set of moral norms which are comprised of the individual's salient perception of the moral correctness or incorrectness of performing a behaviour, and so are concerned with personal feelings of obligation in the matter.

III. Critical Incident Analysis

The critical incident technique was originally developed by [27] to analyse critical incidents related to learning and student identity. Critical incidents detail "true-life events in professional activity which the member of a profession regard both as important and as factual evidence of good and bad practice" and the analysis of these are then used for professional education particularly relevant to practice [28]. Following Donald Schön's idea of the reflective practitioner [29], the critical incident technique is also part of the critical reflection model [30]. Here, critical incidents are used to reflect on practices, elicit embedded assumptions, and to help each other "derive changed practices and theories about practice that result from their reflections" [30]. In our study we apply the critical incident technique using it as a way of framing the analysis of a critical incident that occurred in an educational setting in an undergraduate course in a Swedish research university.

IV. The Course and the Intention of the Changes Made

The incident under study occurred in an introductory course in Human-Computer Interaction (HCI) given at Uppsala University to Computer Science Bachelor students in their third year. The course previously had problems with motivating students despite several attempts to reorganise and restructure its content. The overall structure of the course under focus was inherited from earlier course instances, and this particular course instance was the penultimate before another major reorganisation of the course.

There were around 50 students taking the course, of which 12 were women and 38 were men. In the end, 4% failed the course.

The set-up of the project-based course is illustrated in Figure 1 (see below). The faculty of the course had good contacts in health care so this became the focus of the students' respective projects. Students formed teams of 3-4 people and teams were then organized into bigger seminar groups (abbreviated SG in Figure 1) comprising four teams each. The projects comprised three phases, each corresponding to a specific aspect of the user-centered design cycle and including one or several assignments. There were both group and individual assignments (respectively abbreviated GA and IA in Figure 1). Each phase ended with a compulsory seminar (abbreviated S in Figure 1) where students had to present their work to the three other teams within their assigned seminar group.

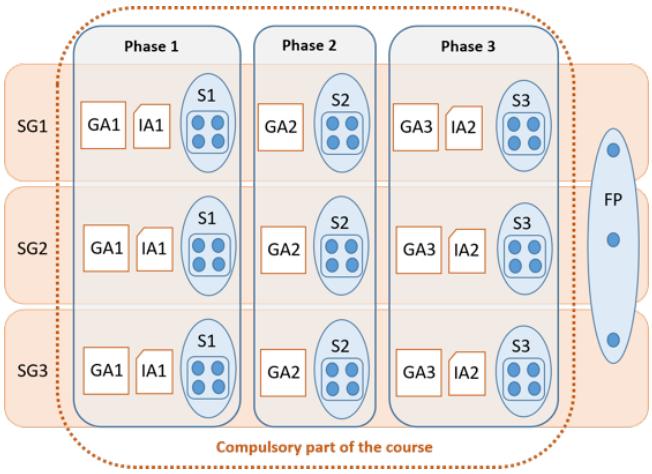

Fig. 1. The course set up: teams of students were organized into three bigger seminar groups (SG) throughout all three phases of the projects. In each phase, one or several assignments needed to be handed in. There were both group assignments (GA) and individual assignments (IA). Each phase ended in a compulsory seminar session. After the last compulsory seminar, one team from each seminar group was selected to do a non-compulsory presentation (FP) in front of a jury.

The main changes and additions made in preparation for this course instance were the following:

- A gamification component in the form of a competition between the different teams of students and a final presentation in front of a jury consisting of invited people representing different perspectives of the healthcare sector;
- An expanded project scope allowing students to freely choose from a wide range of health related apps on the market instead of between only two given redesign tasks;
- An increased focus on the content of the projects rather than on the form of the project reports;
- Continuous supervision / tutoring by the course faculty in the form of written feedback on each of the five main milestones of the course.

In the context of this paper, the gamification component is the most interesting modification made to the inherited course set up. It consisted of a competition between the different teams of students and was based on the teams' presentations of their work during the three mandatory seminars. As mentioned above and illustrated in Figure 1, the different teams of students were organized into three different seminar groups. The distribution of the teams between the three sessions was fixed and did not change throughout the course. This means that each team presented in front of the same audience, and always saw the presentations of the same classmates throughout the course. At the end of each presentation, the classmates in the audience were asked to rate the presenting team's project according to four pre-given criteria (the criteria were different for each seminar and based on the learning outcomes of the course) on a scale from 1 to 10. After the three seminar sessions, the course faculty rated in turn each presentation according to the same four criteria given to the students. Students and faculty ratings each made out 50% of the total amount of points obtainable for each seminar. At the end of the third and final mandatory seminar, the three teams ranking first in their respective seminar group were selected for the final, non-compulsory presentation before the jury. The students were informed at the start of the course that all team members from the team chosen by the jury would receive cinema gift cards as a reward.

At the end of the course three people were invited as members of the jury. The jury was chosen to fit the eHealth app redesign project task. The first member of the jury was the manager of the division in charge of eHealth at the eHealth Government Organisation at a national level in Sweden. The second member of the jury was a medical doctor now working with eHealth at the County Council of Uppsala. The third member was a full professor of human computer interaction with a special focus on eHealth.

The two main intentions behind the addition of this gamification component to the course were first to increase students' motivation by encouraging them to collect as many points as possible and thus do the best work possible, and second to reinforce their learning outcome by having them analyse and assess their peers' projects. The students were expected to:

- give more time and thought to their course project in order to collect a maximal amount of points and end up among the three teams presenting before the jury;
- follow closely the work of their peers (the three other teams pertaining to the same seminar group) in order to be able to rate their work.
- be motivated by the gamification component when presenting the projects.

V. Method and Data Collected

The Theory of Planned Behaviour (TPB) will help us understand how students behaved in a critical incident related to the gamification component described above. The critical incident will thus provide a focus for data collection and the TPB will provide a structure to capture underlying factors for the behaviour. The deeper analysis of the students' behaviour made possible by the TPB will then allow a better understanding of the critical incident.

Part of the data used when analysing the critical incident are from two anonymous surveys sent to the students of the course. The surveys had a response rate of 51% and 37% respectively, and included likert scale questions as well as open ended questions. The survey questions related to the learning experience of the course, and included multiple choice answers as well as free text answers. The questions included for example:

- How satisfied are you with the course in general?
- This has been especially good about the course:
- This could be improved in the course: (Make your suggestions as constructive as possible.)
- To what extent have you made the effort to benefit from the course content?
- What do you think about the idea to have a competition as a part of the course?

The surveys were sent out in the middle of the course, and after the course had finished. In the analysis, we have also used data from participatory observations in the created learning situations, and especially in the critical incident as well as written communication with students. The data is categorised according to the different aspects described in the TPB, as depicted in figure 2.

VI. The Critical Incident: Description and Analysis

A. Description

The critical incident analysed in this paper is related to the gamification component introduced in the course. The behaviour of most students were quite the opposite compared with the intentions behind the gamification intervention. The unexpected behaviour had its pinnacle on the day before the presentation of the three top projects for the external jury. One of the groups that was a candidate for being selected to be in the final seminar with the jury stated that they would refuse to present, and another group was chosen as their substitute. Then later on yet another of the three groups declined the opportunity to present, and we ended up having only two groups presenting. There were indications of students

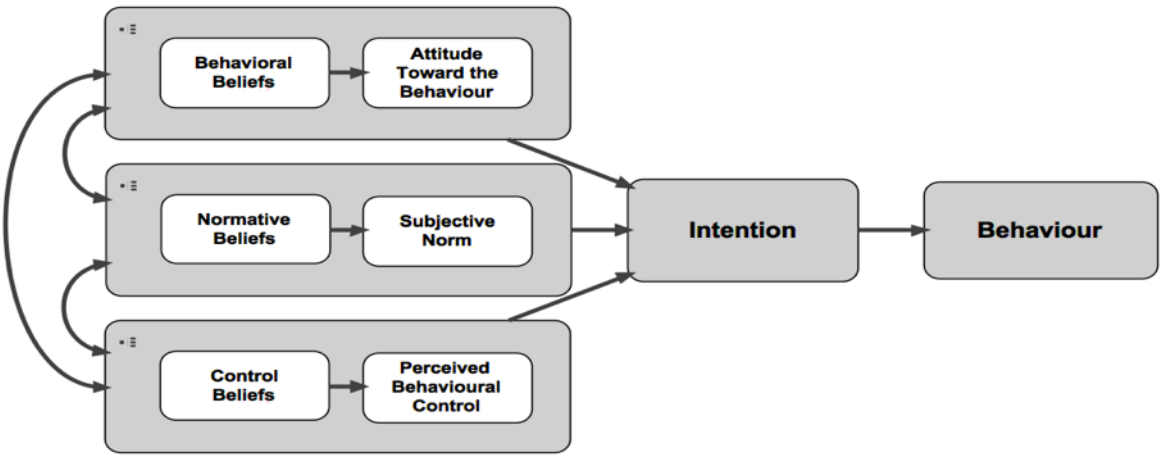

Fig. 2. Schematic representation of the Theory of Planned Behaviour.

consciously performing at a lower level than their ability and eventually only one student showing up (out of a potential forty students) at the final event.

Some of the students clearly thought that presenting in front of a jury is only extra work, and that they would not benefit from it at all, as indicated in these quotes:

> *"Our group purposely did a subpar job so that we wouldn't have to do an extra presentation in front of a jury."*
>
> *"Completely unnecessary that we should put our energy on presenting for a jury. You do not seem to understand how students work. A competition where the prize is to do an extra presentation.."*
>
> *"The competition should definitely be taken out of the course. It is obvious that almost nobody wants to "win" it. It may be an opportunity for some people, but if you are not at all interested in working with HCI it is simply a punishment for performing well."*

There are also positive sides to the event, and in the course evaluation 70% thought that the competition should be kept as a part of the course. Two of the students wrote:

> *"It's a great motivation to really be good at the seminars."*
>
> *"The competitive environment is a good strategy."*

During the two student presentations faculty were positively surprised by the quality of the work, and the open atmosphere in the groups. The jury members asked questions related to the design projects presented, and during the coffee break the students giggled and mingled with the jury members, for example joking about bribing them so that they would win the prize. After the winners had been announced the jury stayed behind to discuss the different projects with students and faculty, at the same time as the winning team took photos of their group to post in social media holding up the awards to be visible in the photo. Faculty experienced the final seminar as a positive learning experience for the students present, who really took the opportunity to network and to make a good impression.

Table I presents the two most relevant observations about the student behaviour in the critical incident as well as the corresponding.

TABLE I
TWO CASES OF MISMATCH BETWEEN INTENDED AND OBSERVED BEHAVIOUR

Identifier	Students behaviour related to the critical incident	Intended behaviour
SB1	Refusing to present. Two groups, one eligible and one selected for the presentation before jury, refused to take part in presentation.	Students would attend the final seminar, and look forward to presenting their ideas for redesign in front of a jury.
SB2	Not attending. Only two of around 40 non-presenting student showed up for the final presentation before jury.	Students would attend their peers' final presentation before jury.

B. Analysis

In this section we will use the Theory of Planned Behaviour (TPB) to make a deeper analysis of the behaviour of the students in the two cases presented in table I. This is done through sorting the data into the three different beliefs of TPB:

- *Attitude towards the behaviour*: According to the TPB the aggregated "behavioural beliefs", or likely consequences of the behaviour, produce a favourable or unfavourable "attitude towards the behaviour".
- *Subjective norm*: According to the TPB the aggregated "normative beliefs", or beliefs about the normative expectations from others, result in "subjective norms".
- *Perceived behaviour control*: According to the TPB the aggregated "control beliefs" are factors that facilitate or impede performance of the behaviour, and they result in "perceived behavioural control norms".

Tables II and III list the identified behavioural beliefs according to this sorting.

TABLE II
ANALYSIS OF SB1: REFUSING TO PRESENT

Attitude Toward the Behaviour

Some identified behavioural beliefs are:

- Presenting in front of a jury is extra and unnecessary work.
- The effort needed to prepare and carry out the presentation is too big in relation to the benefits I will draw from it.
- Not presenting takes away the risk that I might fail in doing a good presentation.
- Presenting would not provide learning that is of interest to me.
- There are other courses that have a more relevant content than this course. If I don't present I will have more time for those courses.
- There will be no negative consequences if I skip the presentation.
- My grade will not be affected if I skip the presentation.
- Someone else could present if I don't present.
- There will be no consequence since the teachers can't do anything if I refuse to present.
- Professional skills such as presentation technique and networking abilities are irrelevant for me to learn.
- I am good enough already, and I don't need this learning opportunity.
- Few of the students will really bother if I refuse.
- I will pass the course independently of whether I present of not.

Subjective Norm

Some of the normative beliefs found in the data are:

- We do not learn through presenting in front of a jury.
- Groups have tried not to win the competition, others do not want to win.
- My fellow students expect me not to (want to) present.
- The HCI course is not important to me / for my computer science education, and the others do not expect me to put effort into this course.
- We should focus on learning the core computer science things such as databases, communication protocols and the like.
- My teachers might be a bit disappointed at me since I do not present.
- The jury would expect me to present something I am unable to present.
- The final seminar is not my responsibility. It is the responsibility of the teachers.
- My peers will know that we refused to present, and they will think that was ok.

Perceived Behavioural Control

Some of the normative beliefs found in the data are:

- I feel no obligation to present.
- There are clashes with other classes at the time of the presentation.
- There was little time to prepare the presentation.
- If other students in my group have clashes with this course and cannot attend, we will not present our group's work.
- Presenting in front of a jury was not a part of the course description, and hence not a compulsory part of the course.
- The teachers can't do anything if I refuse to present.

VII. DISCUSSION

One can discuss these results in relation to the notion of social identity, which can be seen as a part of the subjective norm. The social identity related to how students ought to feel, do, and think in order to be recognised as legitimate, as "a real" computer science students. If recognition as a real computer science student entails an interest in and competence in technical problem solving [31], then students may distance themselves from "softer", more social, or subjective aspects of computing in order to not be marginalised.

The following quote demonstrates how showing an interest in HCI can imply to be marginalised as a computing person. The quote is taken from an interview at the end of study year 3, that was conducted as a part of Peters longitudinal study [32].

> *"The teacher [of the HCI course] was very interested in HCI, and we could really feel that. We thought: 'He is not a real computer scientist!'. (laughs) But then it turned out that he actually could program and that he was as good as we are, perhaps even better. Just that he had an interest for that which was a bit fuzzy."*

Showing an interest in this course can hence imply to be seen as incompetent when it comes to more technical aspects. This could explain the following quote by one of the student in the evaluation:

> *"For many students (like myself) [the competition / gamification component] is an incentive to NOT do (too) well, since they simply do not want the prize."*

Previous studies into the identity development in this particular study program suggest that the norm, after the second year of studies, is to value technical competence and, in particular, proficiency in programming complex system behaviours that are hidden to users of the system [31]. The main topic of the HCI course is, by that standard, neither highly regarded nor seen as relevant to the students future professional activities. The current changes to the course were made with these research results in mind.

Faulkner describes two engineering identities, a technical and a more heterogenous [33] [34]. She finds that many

TABLE III
ANALYSIS OF SB2: NOT ATTENDING

Attitude Toward the Behaviour

Some identified behavioural beliefs are:

- There will be no consequence if I don't attend. Other people could attend.
- I will have time to do more important things if I don't attend.
- Not attending will not affect my grades.
- Not attending will not affect my learning.

Subjective Norm

Some of the normative beliefs found in the data are:

- Nothing important or interesting will happen during the presentations.
- The other students don't expect me to be interested in their work.
- The other student's don't want me to listen to the presentation.
- Other students expect me to have other, and better things to do.
- The teachers will be disappointed if I don't come.
- Other students expect me to be interested in other, more important subjects within the programme.
- Other students are not interested in the topic of the course, and don't expect me to be interested either.

Perceived Behavioural Control

Some of the normative beliefs found in the data are:

- I feel no obligation to attend.
- There are clashes with other classes at the time of the presentation.
- Attending the presentation was not compulsory.
- The final presentations were the teachers responsibility.
- I have heard and seen the projects being presented before, and probably few new things will emerge.

male students take on a technical identity, possibly because this identity converges with available mens gender identities, i.e. being rational (not subjective), solving difficult problems, doing the technical and not the social. And as most students in the course were male, this could explain some of their thoughts about the course content.

It should be noted that this analysis was made post mortem, and that we thus missed the opportunity to develop a questionnaire explicitly developed for the Theory of Planned Belief [23] for gathering data specifically about the critical incident. This could be seen as a general problem with analysing critical incidents, since they typically occur when not expected. The data is nevertheless rich enough to give interesting insights and this study should hence be seen as an example of the potential of the method we propose.

Using the Theory of Planned Behaviour in this way gives a structured view of motivations and beliefs from a student perspective. It pinpoints aspects where teachers beliefs differ from students and that can be addressed (in this course and in previous courses). Examples are:

> *"Presenting would not provide learning that is of interest to the student."* (SB1)

and

> *"Nothing important or interesting will happen during the presentations."* (SB2)

These quotes show that students do not see presentations and the following discussions as learning opportunities and thus do not see the benefits of interacting with the invited jury.

Using this structure, the frequency of aspects connected to students trying to optimize use of their time become clear. From that perspective, non-mandatory attendance together with the perceived non-core topic and lack of benefit become compelling arguments not to attend.

VIII. CONCLUSION

This paper introduces the Theory of Planned Behaviour (TPB) as an approach to the analysis of critical incidents in higher education. Critical incidents are by their very nature often unexpected, which complicates the process of analysis, since well structured empirical data is seldom available.

In this paper we have demonstrated how TPB is applied in practice to a critical incident which emerged at the conclusion of a course in our department. The analysis both illustrates the use of the method, and its application to data such as student reflections, course evaluation survey data and teacher reflections and observations.

The analysis reveals several tensions in the academic setting and helps to provide a structured view of student expectations of the consequent implicit educational norms to which they expect both their peers and teachers to conform.

We find the method useful as a part of the overall quality analysis process in our department and recommend it for wider systematic quality assurance work in engineering education.

In this paper we used TPB to gain insights into the behaviour of the students and that there is a focus on negative, from the faculty point of view, behaviour. We posit that the study of positive, from the faculty point of view, would

provide important insights with regard to creating educational settings. To use TPB in analysing faculty behaviour is perhaps not as obviously useful, but further work should be done in investigating this avenue of educational research.

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REFERENCES

[1] I. Hampson and A. Junor, "Invisible work, invisible skills: interactive customer service as articulation work," *New Technology, Work and Employment*, vol. 20, no. 2, pp. 166–181, 2005.

[2] A.-K. Peters, W. W. Hussain, Å. Cajander, T. Clear, and M. Daniels, "Preparing the global software engineer," in *Proc. IEEE International Conference on Global Software Engineering*, Ciudad Real, Spain, Jul. 2015, pp. 61–70.

[3] M. Daniels, Å. Cajander, A. Pears, and T. Clear, "Engineering education research in practice: Evolving use of open ended group projects as a pedagogical strategy for developing skills in global collaboration," *International journal of engineering education*, vol. 26, no. 4, pp. 795–806, 2010.

[4] C. Lampe, "Citizen interaction design: teaching hci through service," *Interactions*, vol. 23, no. 6, pp. 66–69, 2016.

[5] S. H. Billig and A. S. Waterman, *Studying Service-Learning: Innovations in Education Research Methodology*. New York, NY: Routledge, 2014.

[6] U. Schiefele and M. Csikszentmihalyi, "Motivation and ability as factors in mathematics experience and achievement," *Journal for research in mathematics education*, vol. 26.

[7] S. Bolkan, A. K. Goodboy, and D. M. Kelsey, "Instructor clarity and student motivation: Academic performance as a product of students' ability and motivation to process instructional material," *Communication Education*, vol. 65, no. 2, pp. 129–148, 2016.

[8] M. Kunter, Y.-M. Tsai, U. Klusmann, M. Brunner, S. Krauss, and J. Baumert, "Students' and mathematics teachers' perceptions of teacher enthusiasm and instruction," *Learning and Instruction*, vol. 18, no. 5, pp. 468–482, 2008.

[9] U. Schiefele, L. Streblow, and J. Retelsdorf, "Dimensions of teacher interest and their relations to occupational well-being and instructional practices," *Journal for educational research online*, vol. 5, no. 1, p. 7, 2013.

[10] U. Schiefele, "Classroom management and mastery-oriented instruction as mediators of the effects of teacher motivation on student motivation," *Teaching and Teacher Education*, vol. 64, pp. 115–126, 2017.

[11] D. Dicheva, C. Dichev, G. Agre, and G. Angelova, "Gamification in education: A systematic mapping study." *Educational Technology & Society*, vol. 18, no. 3, pp. 75–88, 2015.

[12] V. Tinto, "Dropout from higher education: A theoretical synthesis of recent research," *Review of educational research*, vol. 45, no. 1, pp. 89–125, 1975.

[13] E. Durkheim, "Suicide: A study in sociology (ja spaulding & g. simpson, trans.)," *Glencoe, IL: Free Press.(Original work published 1897)*, 1951.

[14] C. M. Evertson and C. S. Weinstein, *Handbook of classroom management: Research, practice, and contemporary issues*. Routledge, 2013.

[15] A. H. Maslow, "A theory of human motivation." *Psychological review*, vol. 50, no. 4, p. 370, 1943.

[16] A. Bandura, "Social foundations of thought and action: A social cognitive perspective," *Englewood Cliffs, NJ: Princeton-Hall*, 1986.

[17] W. Hardeman, M. Johnston, D. Johnston, D. Bonetti, N. Wareham, and A. L. Kinmonth, "Application of the theory of planned behaviour in behaviour change interventions: A systematic review," *Psychology and health*, vol. 17, no. 2, pp. 123–158, 2002.

[18] J. Ogden, "Some problems with social cognition models: a pragmatic and conceptual analysis." *Health Psychology*, vol. 22, no. 4, p. 424, 2003.

[19] M. Conner and P. Sparks, "Theory of planned behaviour and health behaviour," *Predicting health behaviour*, vol. 2, pp. 170–222, 2005.

[20] T. Sommestad and J. Hallberg, "A review of the theory of planned behaviour in the context of information security policy compliance," in *IFIP International Information Security Conference*. Springer, 2013, pp. 257–271.

[21] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS quarterly*, pp. 319–340, 1989.

[22] M. Fishbein and I. Ajzen, "Belief, attitude, intention, and behavior: An introduction to theory and research," 1977.

[23] I. Ajzen, "The theory of planned behavior," *Organizational behavior and human decision processes*, vol. 50, no. 2, pp. 179–211, 1991.

[24] C. J. Armitage and M. Conner, "Efficacy of the theory of planned behaviour: A meta-analytic review," *British journal of social psychology*, vol. 40, no. 4, pp. 471–499, 2001.

[25] R. H. Fazio, "Multiple processes by which attitudes guide behavior: The mode model as an integrative framework," *Advances in experimental social psychology*, vol. 23, pp. 75–109, 1990.

[26] M. Conner and C. J. Armitage, "Extending the theory of planned behavior: A review and avenues for further research," *Journal of applied social psychology*, vol. 28, no. 15, pp. 1429–1464, 1998.

[27] J. C. Flanagan, "The critical incident technique," *Psychological bulletin*, vol. 51, no. 4, p. 327, 1954.

[28] W. R. Dunn and D. D. Hamilton, "The critical incident techniquea brief guide," *Medical Teacher*, vol. 8, no. 3, pp. 207–215, 1986.

[29] D. A. Schön, *The reflective practitioner: How professionals think in action*. Hachette, UK: Basic Books, 1984.

[30] J. Fook and F. Gardner, *Practising Critical Reflection: A Resource Handbook*. Berkshire, UK: McGraw-Hill Education, 2007.

[31] A.-K. Peters, A. Berglund, A. Eckerdal, and A. Pears, "Second year computer science and it students experience of participation in the discipline," in *Proc. of the 15th Koli Calling Conference on Computing Education Research*, Koli, Finland, Nov. 2015, pp. 68–76.

[32] A.-K. Peters, "The role of students identity development in higher education in computing," Uppsala, Sweden, 2014, Licentiate Thesis.

[33] W. Faulkner, "The technology question in feminism: A view from feminist technology studies," *Women's studies international forum*, vol. 24, no. 1, pp. 79–95, 2001.

[34] ——, "Nuts and bolts and people'gender-troubled engineering identities," *Social studies of science*, vol. 37, no. 3, pp. 331–356, 2007.