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Extending the Theory of Planned Behaviour to Predict and Increase PASS Attendance and Students'  
Performance: Can Academic Motivation Improve Efficacy?

Enrique L.P. Mergelsberg<sup>1</sup>, Darren Haywood<sup>2</sup>, Barbara V. Mullan<sup>1</sup>, Raphael Pereira<sup>3</sup>, Amanda Smith<sup>3,4</sup>, Melissa Zaccagnini<sup>5</sup>, and Peter J. Allen<sup>2,6</sup>

<sup>1</sup> Health Psychology & Behavioural Medicine Research Group, School of Psychology, Curtin University, Western Australia, Australia

<sup>2</sup> School of Psychology, Curtin University, Western Australia, Australia

<sup>3</sup> UniPASS, Teaching and Learning Centre, Curtin University, Western Australia, Australia

<sup>4</sup> Learning Success, University Library, Curtin University, Western Australia, Australia

<sup>5</sup> Australasian PASS Training Centre, University of Wollongong, New South Wales, Australia

<sup>6</sup> School of Psychological Science, University of Bristol, United Kingdom

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Correspondence concerning this article should be addressed to Barbara Mullan, Health Psychology & Behavioural Medicine Research Group, School of Psychology, Curtin University, GPO BOX U1987, Perth, Western Australia, 6845. Email: [barbara.mullan@curtin.edu.au](mailto:barbara.mullan@curtin.edu.au)

### Abstract

**Background:** Peer assisted study sessions (PASS) is an international, widely adopted, supplementary instruction program that has shown to have multiple academic benefits for students. However, PASS attendance rates across the world are typically very low, and the reasons for this are unclear. **Aim:** (1) To test the predictability of the theory of planned behaviour (TPB) on PASS attendance and subsequently students' academic performance; (2) To assess the role of students' motivation within the TPB; e.g., can motivation close the intention-behaviour gap; (3) To test whether a large scale intervention based on the TPB can improve PASS attendance and subsequently improve students' academic performance. **Sample and Method:** TPB measures, academic motivation, PASS attendance and final unit grade were assessed three times pre-intervention across two Australian universities ( $N=965$ ) and modelled using Latent Variable Analysis. The intervention consisted of a series of 'PASS Facts' delivered to students (total  $N=2087$ ) via multiple media. **Results:** The findings showed that the TPB predicted PASS attendance and performance. Academic motivation predicted performance, but it did not close the intention-behaviour gap nor moderate the PASS attendance-performance relationship. Furthermore, in all three implementations, the interventions did not increase the theoretical constructs. **Conclusions:** The TPB is useful for predicting PASS attendance and can be extended to predict students' performance. Future research should investigate factors other than academic motivation to attempt to close the intention-behaviour gap. Future research may also develop a more active intervention, wherein students can practice a skill (i.e., time management) instead of passively receiving messages.

*Keywords:* Intervention; Theory of Planned Behaviour (TPB); Peer Assisted Study Sessions (PASS); Peer Assisted Learning (PAL); Peer Learning; Attendance, Supplementary Instruction

**Declaration**

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**Conflicts of interest/Competing interests**

The authors have no conflicts or competing interests to disclose.

**Availability of data and material**

Data will be made available on request.

**Code availability**

R-Statistics code will be made available on request.

## 1.0 Background

Peer assisted study sessions (PASS; also known as peer assisted learning) is an internationally used, and widely adopted, supplementary instruction support in which regularly scheduled peer-learning sessions are run parallel to regular classes in 'high-risk' units with the goal of increasing student success (Martin, 2008). These 'high-risk' units are typically undergraduate level and often characterised by higher than average fail and withdrawal rates, large classes for which attendance is not recorded, extensive weekly readings, infrequent assessment, and a reputation amongst students for being difficult (Arendale, 1994). Attendance at PASS sessions is voluntary and open to all students enrolled in supported units. In a typical PASS session, attendees work collaboratively on active and experiential learning tasks, and take responsibility for teaching each other the course material. The peer-learning sessions are facilitated by higher year students with strong interpersonal skills, who have recently successfully completed the units they support. These peer-learning facilitators are in turn supported by accredited PASS supervisors. The role of peer-learning facilitators is to design and facilitate group activities that promote student engagement with unit content and academic skills development. They are not tutors or teaching assistants, do not introduce 'new' content to students, and are not involved in unit assessment.

Theoretically, the PASS model builds on constructivist approaches to learning and cognitive development, as well as principles of social interdependence and self-regulation (Hurley, Jacobs, & Gilbert, 2006; Ning & Downing, 2010). These theories have proposed that social learning with peers has a powerful effect on both student academic and non-academic outcomes (Tudge & Winterhoff, 1993; Wentzel, 1999). In line with theory, studies that tested the efficacy of PASS on academic outcomes have consistently demonstrated that regular PASS attendance is positively associated with positive academic outcomes like higher grades, improved retention and timely graduation, as well as negatively associated with failure and withdrawal (see Dawson, van der Meer, Skalicky, and Cowley (2014) for a systematic review). Moreover, PASS attendance has shown to have a positive effect on non-academic, socioemotional outcomes in elementary school students, like development of friendship skills, autonomy, self-esteem, and behavioural control (see for meta-analysis: Ginsburg-Block, Rohrbeck, & Fantuzzo, 2006).

## 1.2 The Problem of Low PASS Attendance

Despite the positive results of attending PASS, across the world supplementary instruction programs, such as PASS, do not attract a large number of attendees like many opt-in academic support programs (e.g., Cornelius, Wood, & Lai, 2016; Duah, Croft, & Inglis, 2014; Durkin & Main, 2002; Harding, Engelbrecht, & Verwey, 2011;

Rath, Peterfreund, Xenos, Bayliss, & Carnal, 2007). The majority of students to whom PASS is offered never attend (Dancer, Morrison, & Smith, 2007; Dancer, Morrison, & Tarr, 2015; Kochenour, Jolley, Patrick, Roach, & Wenzler, 1997). However, relative to the volume of research focused on the academic benefits of PASS attendance (Dawson et al., 2014), comparatively fewer studies have investigated reasons why most students do not attend. Amongst these studies, commonly cited reasons for non-attendance include the belief that PASS is unnecessary or a waste of time. Students report often that PASS sessions clash with other commitments, are scheduled at inconvenient times, or they report having a dislike of the collaborative nature of PASS and feelings of threat or discomfort associated with working with peers (Blunt, 2008; Ginty & Harding, 2014; Worthington, Hansen, Nightingale, & Vine, 1997). Non-attendance has also been associated with several demographic and motivational factors, like decreased learning commitment (McGee, 2005). Moreover, only a small fraction of students who do attend, attend at a level that could be considered 'regular' (Allen, Tonta, Haywood, Pereira, & Roberts, 2017). In one recent large-scale study students attended an average of just below 3 out of 12 sessions per semester (Paloyo, Rogan, & Siminski, 2016). Given the well-established benefits of PASS, efforts to increase PASS attendance levels are warranted.

### **1.2.1 Explaining Low PASS Attendance with the Theory of Planned Behaviour**

We have chosen the theory of planned behaviour (TPB) as the framework wherein we attempt to predict and increase PASS attendance. TPB is a widely used framework to explain behaviour (Ajzen, 1991) and has previously been used to understand the low PASS attendance (Allen et al., 2017; Goldstein, Sauer, & O'Donnell, 2014; White, O'Connor, & Hamilton, 2011; White, Thomas, Johnston, & Hyde, 2008). The theory proposes that behaviour is best predicted by behavioural intentions, and that behavioural intentions are best predicted by attitudes, subjective norms and perceived behavioural control (Ajzen, 1991). Attitudes refer to positive or negative thoughts about the behaviour in question. Subjective norms refer to whether we think that people like us engage in the behaviour, and whether people who are important to us think that we should engage in the behaviour. Perceived behavioural control refers to whether we think we can perform the behaviour. The effect of attitudes and subjective norms on behaviour are indirect (via intentions), whereas the effects of perceived behavioural control on behaviour are both indirect and direct.

Using this framework, Goldstein et al. (2014) reported that attitudes and subjective norms significantly predicted students' PASS attendance intentions for introductory accounting courses, and that intentions subsequently predicted behaviour at the beginning and end of the semester, however, perceived behavioural control did not. White

et al. (2011); White et al. (2008) found that attitudes and perceived behavioural control predicted intentions to attend introductory statistics PASS sessions, and that intentions predicted actual attendance. Recently, Allen et al. (2017) reported support for the full TPB model explaining PASS attendance across multiple university subjects at one university. They observed that attitudes, subjective norms and perceived behavioural control each had a significant direct effect on PASS attendance intentions, and that intentions had a significant direct effect on attendance behaviour. Furthermore, attitudes, subjective norms and perceived behavioural control each had an indirect effect on attendance, mediated by intentions. Finally, after controlling intentions, only perceived behavioural control had a significant direct effect on attendance. These results provide strong evidence that the TPB is a good framework to explain PASS attendance in university students.

A problem with the TPB is the large unexplained gap between intention and behaviour (Sheeran & Webb, 2016). Intention accounted between 17% (White et al., 2008) and 42% in PASS attendance (Allen et al., 2017). This suggests that more than half of the variance in PASS attendance remains unaccounted for. Some studies have addressed this gap by adding additional factors into the model. For instance, White et al. (2008) showed that students' role identity accounted for an additional 9% in variance of PASS attendance, however, this was not replicated by White et al. (2011) or Allen et al. (2017). There is a need to further investigate other factors that may close the intention-behaviour gap.

### **1.2.2 The Role of Motivation in Explaining Low PASS Attendance**

According to the self-determination theory, motivation is a continuum with intrinsic motivation on one end, then extrinsic and amotivation on the other end (Ryan & Deci, 2000). Students who are intrinsically motivated study a subject out of pure personal interest, while students externally motivated study a subject for external reasons (i.e., obtain a good job to earn a lot of money). Students who are amotivated are not motivated at all. It is well established that these motivation types affect learning and study behaviour (Kusurkar, Ten Cate, van Asperen, & Croiset, 2011; Vansteenkiste, Lens, & Deci, 2006; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004) and they may explain engagement with PASS attendance. Academic motivation has shown to be a predictor of PASS attendance, such that students with higher motivational levels were more likely to engage in PASS (McGee, 2005). However, McGee (2005) measured academic motivation differently than suggested by the self-determination theory; he assessed six specific constructs: intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance, and test anxiety. Thus far, there has been no empirical investigations

assessing whether the intention-behaviour gap in PASS attendance can be closed by students' academic intrinsic motivation. It is possible that intrinsic academic motivation, according to the self-determination theory, closes the intention-behaviour gap; those intrinsically motivated concerning their university education and high in intention to attend PASS actually attend PASS as opposed to those who are intending but are externally motivated.

### **1.2.3 Intervention to Increase PASS Attendance**

Besides explaining low PASS attendance, it is also important to increase PASS attendance to improve academic performance in university students. While the literature seems to agree that PASS has numerous benefits for students, there are no studies, to the best of our knowledge, that have developed interventions to improve engagement with PASS. The TPB can be a good framework to develop an intervention to increase PASS attendance. In addition to its utility for predicting behaviour, including PASS attendance, the TPB has served as the theoretical framework underpinning numerous successful behaviour change interventions (Steinmetz, Knappstein, Ajzen, Schmidt, & Kabst, 2016). In their meta-analysis, conducted on 82 papers reporting 123 behaviour change interventions, they found that TPB interventions successfully change behaviour with a large effect size ( $d = 0.50$ ). Additionally, TPB interventions successfully increased all behavioural predictors (i.e., attitude [ $d = 0.4$ ], subjective norms [ $d = 0.14$ ], perceived behavioural control [ $d = 0.26$ ] and intention [ $d = 0.34$ ]). Moreover, they found that TPB based interventions were most successful when implemented in a group ( $d = 0.87$ ) and public ( $d = 0.76$ ) setting.

For further research aiming to increase PASS attendance, Goldstein et al. (2014) recommended to use students' testimonials. These testimonials could be based on the TPB framework, such that these testimonials target students' attitudes, subjective norms, perceived behavioural control and intention to attend PASS, subsequently improving PASS attendance in the student population. A TPB based intervention, using student's testimonials, targeted to all students across the university may be successful in increasing PASS attendance and subsequently improving academic performance.

## **2.0 The Current Study**

The first purpose of this study was to test the predictability of the TPB on PASS attendance by testing whether the theory can predict PASS attendance and subsequently students' academic performance. The second aim was to assess the role of students' motivation within the TPB; i.e., can intrinsic motivation predict PASS attendance and close the intention-behaviour gap as well as directly predict students' academic performance, as found in previous studies (Allen et al., 2017; Dawson et al., 2014; McGee, 2005). Lastly, this study intended to test whether



students' testimonials based on the TPB framework can improve PASS attendance and subsequently improve students' academic performance.

Overall, it was hypothesised that at start of semester, students' attitudes, subjective norms, perceived behavioural control regarding PASS attendance would predict their intention to attend PASS (H1a). Intention and perceived behavioural control to attend PASS at the start of the semester would further predict PASS attendance during that semester (H1b). It was further hypothesised that PASS attendance would predict students' academic performance indicated by their final grade (H1e). Moreover, it was hypothesised that the intention-behaviour (H2a) and intention-students' grade relationships (H2b) would be moderated by academic motivation, such that these relationships were strong for students with internal type of motivation, however, attenuated or non-existent in those with external type of motivation. Lastly, it was hypothesised that student testimonials, delivered to the students throughout the semester would increase students' attitudes, subjective norms and perceived behavioural control as well as intentions regarding PASS attendance from pre- to post-semester (H3a). The increase of these constructs would subsequently lead to an increase in PASS attendance (H3b) and subsequently higher grades (H3c).

### **3.0 Methods**

#### **3.1 The Development of the Intervention to Increase PASS Attendance**

##### **Context of the Intervention**

The messages containing students' testimonials were disseminated at two Australian universities (Curtin University and University of Wollongong) over one semester and replicated at Curtin University in the second semester. Both universities are mid-sized teaching and research universities that typically rank in the top tertile nationally (Symonds, 2018). Each has an established PASS program that is accredited by the Australasian Centre for PASS and adheres closely to the Centre's guidelines for best practice (Australasian Centre for PASS, 2010). Following the recommendations of Kok, Peters, and Ruiters (2017), we adopted a social-ecological approach, which takes into account the impact that physical and social environments have on students' learning (Rentoul & Fraser, 1979). Therefore, we used systems that were already in place in the university environment (email, Learning Management System (LMS) announcements, lecture slides, business cards in tutorials) to disseminate messages to students and the two universities and their respective PASS environments were taken into consideration when developing and implementing the intervention. To further ensure relevance, acceptability, contextual and cultural appropriateness, and implementability of the intervention, we widely consulted key stakeholders (including students

that previously attended and had not attended PASS, peer learning facilitators and PASS supervisors) through every step of the intervention development.

### **3.1.1 Intervention Messages: PASS Facts**

The intervention messages were developed as a series of "PASS Facts". A "PASS Fact" consisted of a testimonial, a picture of a student from the universities picture database as well as additional information on how to attend PASS. To develop the testimonials, we held focus groups with students who both regularly attended PASS, and those who did not (regularly) attended PASS to gather information regarding the reasons related to PASS (non) attendance. "PASS Facts" were developed for each TBP construct (attitudes, subjective norms and perceived behavioural control) across each of the dissemination mediums (email, Learning Management System (LMS) announcements, lecture slides/business cards). An example of an email "PASS Fact" testimonial targeted at attitudes was "*I was headstrong, so I thought I didn't need it. But I ended up failing my stats unit. Next semester, I went to UniPASS and went from a 40 to a 70!*". An example of an LMS post targeting subjective norms was "*Did you know? Alongside higher grades, the top-rated aspect of PASS is the social factor...*". Lastly, an example of a business card delivered testimonial targeting perceived behavioural control was "*Did you know? Many students don't know how to study effectively. 1 hour of PASS = 3 hours of studying by yourself!!*". A third focus group was held with a mix of PASS attendees and non-attendees to receive feedback on the developed "PASS facts". Overall, the feedback was positive and only minor changes were made, the final set of "PASS Facts" can be found in the supplemental materials.

### **3.2 Design**

Data were collected online at the start and end of the semester, with a period of around 15 weeks between data collection phases. The intervention was first implemented in Semester 1, 2017, at Curtin University, then refined and adapted for University of Wollongong, and implemented at both universities the following semester. There was no control group, as it was not feasible in a large-scale intervention like this to exclude students from seeing the messages, which were disseminated across the whole university. Prior to its commencement this study was reviewed and approved by the Human Research Ethics Committees at both universities (Reference Number: HRE2016-0519).

### 3.3 Participants

In the orientation week, prior to each semester in which the intervention was deployed, the entire cohort of students enrolled in PASS supported units at each university were invited to complete a pre-intervention questionnaire. In appreciation of their time they were offered the opportunity to enter a prize draw to win one of several AU\$100 gift cards. The total size of each cohort (Cohort  $N$ ) and the number of units they were enrolled in (Units  $N$ ) are reported in Table 1, alongside the number of students who started the pre-intervention questionnaire (Start  $N$ ) and subsequently provided useable pre- (Pre  $N$ ) and post-intervention (Post  $N$ ) data. Cases who answered at least three items per measure were included in our analyses. Missing items for these cases were random and were replaced using expectation maximisation. The final two columns of Table 1 report the demographic characteristics of the Post  $N$  samples.

[INSERT TABLE 1 ABOUT HERE]

### 3.4 Procedure

The intervention materials were disseminated to all students who are eligible to attend PASS via email, Learning Management System (LMS) announcements, lecture slides and business cards distributed in lectures/tutorials according to the schedule in Table 2. The activities in Table 2 occurred in addition to the usual promotional activities for each PASS program. These students, which were almost all first-year students, were invited to fill in the questionnaires pre- and post-semester. Pre- and post-intervention questionnaires were administered online in the weeks specified in Table 2. Each started with a brief description of PASS followed by the appropriate version of the TPB Measure (see Measures section). The post-intervention questionnaire concluded with an intervention evaluation. Each questionnaire took 15-20 minutes to complete. Throughout the semester, students were free to choose whether they attended PASS or not.

It should be noted that our original plan was to use three sets of business cards each semester in each university. However, the distribution of these was costly, labour intensive and environmentally unfriendly. Consequently, after distribution of the second set in Semester 1 at Curtin University, they were replaced with slides presented prior to lectures.

[INSERT TABLE 2 ABOUT HERE]

### 3.5 Measures

#### Theory of Planned Behaviour Measure

Two versions of a 26-item TPB measure adapted from Ajzen (1991) and containing four sub-scales assessed students' attitudes (10 items; e.g., "for me to attend PASS sessions on a regular basis will be very bad/very good"), subjective norms (6 items; e.g., "if they were in my position, most people who are important to me would/would not attend PASS sessions regularly"), perceived behavioural control (6 items; e.g., "for me to attend PASS sessions on a regular basis is possible/impossible"), and intentions (4 items; e.g., "I definitely will/definitely will not make an effort to attend PASS sessions on a regular basis this semester.") regarding PASS attendance. The two versions were identical in content, but varied in tense where necessary (e.g., "for me to attend PASS sessions on a regular basis will be..." in the pre-intervention version vs. "for me to attend PASS sessions on a regular basis is..." in the post-intervention version). Participants responded to each item on a 7-point scale and, after reverse scoring the relevant items, higher mean sub-scale scores corresponded to stronger attitudes, subjective norms, perceived behavioural control, and intentions toward PASS attendance. The full set of measures are available at <https://osf.io/pn347/>.

#### 3.5.1 Academic Motivation

The 28-item Academic Motivation scale, the College version (AMS-C 28; Vallerand et al., 1992) was modified to be applicable for University students. It was used to assess student's intrinsic and/or extrinsic motivation to be enrolled in University at the start of semester. Each item was scored on a 7-point Likert scale ranging from 1 'does not correspond at all' to 7 'corresponds exactly'. The scale divides academic motivation three sub-types. The first subtype is *internal motivation*, which has three sub-types of its own: *to know* (4 items, e.g., 'Because I experience pleasure and satisfaction while learning new things'); *toward accomplishment* (4 items, e.g., 'For the pleasure I experience while surpassing myself in my studies'); *to experience stimulation* (4 items, e.g., 'For the intense feelings I experience when I am communicating my own ideas to others'). The second sub-type of the scale is *external motivation*, which again consists of three sub-types of its own: *identified* (4 items, e.g., 'Because I think that a college education will help me better prepare for the career I have chosen'); *introjected* (4 items, e.g., 'To prove to myself that I am capable of completing my University degree'); *external regulation* (4 items, e.g., 'Because with only a high-school degree I would not find a high-paying job later on'). The third sub-type of the scale is *amotivation* (4 items, e.g., 'I once had good reasons for going to University; however, now I wonder whether I should

continue'). After the reverse scoring of half of the items, a weighted score was calculated per regulation type (a motivation \* (-3) + external regulation \* (-2) + introjection \* (-1) + identified \* (1) + intrinsic motivation to accomplish and to stimulate\* (2) + intrinsic motivation to know \* (3)) and can range from -136 (externally motivated) to 152 (internally motivated).

### **3.5.2 Intervention Evaluation Measure**

In this measure students were first asked to indicate whether they recalled seeing "PASS Facts" distributed via email, LMS announcements, lecture slides or business cards over the semester. This was to ensure that students received the TPB intervention. Then, using an acceptability and feasibility measure adapted from Kothe and Mullan (2012), we asked about the extent to which participants found each type of "PASS Facts" relevant, interesting, helpful/useful, worthwhile, easy to understand, too long, too short and annoying. Students' responded to these items on scales ranging from 1 (strongly disagree) to 5 (strongly agree). Responses to the personal relevance item were analysed separately, and a mean valence score were calculated by averaging responses to the remaining seven items (following reverse coding where applicable). Finally, we asked whether the "Pass Facts" motivated students to attend PASS, and if they would like to see them again in the future. Students responded to these items on 7point Likert scales ranging from 1 (not at all) to 7 (very much).

### **3.5.3 PASS Attendance, Demographics and Academic Performance**

Comprehensive session-by-session PASS attendance records were maintained by the teams responsible for delivering and administering the programs at the two universities. Using this information, we were able to calculate the percentage of sessions attended by each participating student (number of sessions attended/total number of sessions available \* 100). These were the dependent variables in the path models reported herein. Descriptive statistics for this behavioural outcome measure are reported in Table 3. At both universities, the attendance scores were positively skewed (all Shapiro-Wilk tests were significant at  $p < .001$ ) and ranged between 0 - 167 (Curtin University semester 2, with 5 students attending more than once a week), 0 - 209 (Curtin University semester 1, with 11 students attending more than once a week), and 0 - 250 (University of Wollongong, with 62 students attending more than once a week). The PASS attendance records were also used to calculate the average number of participants per session during the intervention, as well as in the year prior. Finally, demographic data and final grade (i.e., academic performance) for each participating student were extracted from university records.

### 3.6 Data Preparation and Analysis

The University data (demographics and academic performance) were linked with the survey data and the weekly attendance data provided by PASS using R statistics. The data of the three Universities were collated into one data file, and this was used in a series of paired samples *t*-tests in SPSS version 24 in order to test the hypothesis that students' attitudes, subjective norms, perceived behavioural control, and intentions vis-à-vis PASS attendance would be higher post-intervention than they were pre-intervention (H3a). The R statistics package 'Lavaan' (Rosseel, 2012) was used to test the a-priori model (see Figure 1).

[INSERT FIGURE 1 ABOUT HERE]

A stepwise approach was taken that tested four components of the a-priori model separately (see Figure 2). The first sub-model tested whether intention mediates the relationships between the predictors (i.e., pre-intervention attitudes, subjective norms and perceived behavioural control) and PASS attendance (H1ab). The second sub-model tested whether students' final grade can be predicted by PASS attendance (H1c), which is expected to be predicted by intention. The third sub-model tested whether academic motivation closes the intention-behaviour gap, thus moderating the relationship between intention and PASS attendance (H2a). The fourth sub-model tested whether academic motivation moderates the association between PASS attendance and students' final grade (H2b). All standard errors of the sub-models were bootstrapped with 1000 iterations. If any of these sub-models was poorly specified, they were not included in the final model.

[INSERT FIGURE 2 ABOUT HERE]

As suggested by Hu and Bentler (1999), three indices were used to assess goodness of fit of each model: the comparative fit index (CFI; values of .95 or greater are desirable), the standardized root-mean-square residual (SRMR; values < .08 are desirable), and the root-mean-square error of approximation (RMSEA; values of < .06 are desirable). Further, the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) were used as a measure of comparison of fit between the models presented. Lower AIC and BIC scores indicate a better fit (Kenny, 2015). CFI's were used to assess the goodness of fit as these are less affected by non-normality (Kenny, 2015). The Shapiro-Wilk test of normality was significant for all variables in the model signalling violation of normality, the histograms as well as the Skewness and Kurtosis indicated that the data was normally distributed for all variables (skewness  $Z < -.509$ , kurtosis  $Z < -.107$ ), except for the outcome variables, PASS attendance was positively skewed (skewness  $Z = 1.75$ , kurtosis  $Z = 3.00$ ) as most participants had not attended PASS ( $n = 530$ ;

55%), unit mark was negatively skewed (skewness  $Z = -1.34$ , kurtosis  $Z = 2.90$ ) as only few participants failed the unit ( $n = 68$ ; 7%). Non-normal data with high kurtosis values inflates chi-square and absolute measures of fit (Kenny, 2015), however, the kurtosis values in this dataset are within the acceptable range of  $\pm 3$ .

#### 4.0 Results

##### The Theory of Planned Behaviour as a Framework to Explain of PASS Attendance

Descriptives of all variables, including the zero-order correlations and reliability of all measures are shown in Table 3. The variables correlate significantly and there is no sign of multicollinearity (i.e.,  $r > .850$ ).

[INSERT TABLE 3 ABOUT HERE]

The regression coefficients of all models' direct effects and moderation effects are reported in Table 4. The first sub-model validated the TPB and the first set of hypotheses, such that intention mediated the relationships between the predictors (i.e., pre-intervention attitudes, subjective norms and perceived behavioural control) and PASS attendance data ( $N = 965$ ). The indirect effect of attitude,  $b = 9.38$  ( $SE = 1.23$ ),  $z = 7.62$ ,  $p < .001$ , 95%  $CI(7.13, 11.9)$ , subjective norm,  $b = 4.08$  ( $SE = .671$ ),  $z = 6.08$ ,  $p < .001$ , 95%  $CI(2.86, 5.48)$ , and perceived behavioural control,  $b = 3.94$  ( $SE = .598$ ),  $z = 6.60$ ,  $p < .001$ , 95%  $CI(2.83, 5.20)$  were significant via intention to PASS attendance (H1ab). The second sub-model, testing whether PASS attendance mediated the relationship between intention and students' final grade, also properly specified the data ( $N = 851$ ). As hypothesised (H1c), the indirect effect of intention, mediated by PASS attendance to students' unit grade was significant,  $b = .671$  ( $SE = .171$ ),  $z = 3.92$ ,  $p < .001$ , 95%  $CI(.321, 1.01)$ . The third and fourth sub-models and hypotheses, testing whether academic motivation moderated the relationships between intention and PASS attendance ( $N = 964$ ) and PASS attendance and students' grade ( $N = 850$ ) poorly specified the data. In contrast to what was initially hypothesised (H2a and H2b), academic motivation only predicted students' performance directly, therefore, the moderations were removed from the final model.

[INSERT TABLE 4 ABOUT HERE]

A sensitivity power analysis was conducted with software that generates R code to calculate power (Schoemann, Preacher, & Coffman, 2010). An alpha level of .05, with 10 degrees of freedom, a hypothesised RMSEA of .06 were entered and a power of .999 was computed. This suggests adequate power to find a good fit for the final model.

The final model is shown in Figure 3 and was good fit to the data ( $N = 850$ ),  $X^2(8) = 54.8$ ,  $p < .001$ , CFI = .951, AIC = 18004, BIC = 18051, RMSEA = .083 (90%CI: .063, .104), SRMR = .039. As predicted by the TPB, the indirect effects in the TPB from attitude, subjective norm and perceived behavioural control to PASS attendance via intention were all significant,  $b > 3.19$ ,  $z > 5.82$ ,  $p < .001$ , so were the direct effects between perceived behavioural control and PASS attendance as well as intention to PASS attendance (see Table 4). The proposed extension of the TPB with students' final grade was successful, the direct effect between PASS attendance to final grade was significant, as well as the indirect effects from intention via PASS attendance to unit grade,  $b = .584$ ,  $z = 3.80$ ,  $p < .001$ .

[INSERT FIGURE 3 ABOUT HERE]

#### 4.1 Intervention Effects

As illustrated in Table 5, the hypothesis that the TPB constructs increased from pre- to post-intervention was not supported. In fact, in the majority of instances, students' PASS attendance attitudes, subjective norms, perceived behavioural control, and intentions decreased between the two time points, all  $t < .529$ ,  $p < .001$ ,  $d < 0.17$ . Given that the effect sizes were all small, the decline in the theoretical constructs pre- to post-semester was not practically significant. Overall, these results indicate that the messages distributed to the students did not influence attitude, subjective norm, perceived behavioural control and intention related to PASS attendance.

#### 4.2 Student Evaluation of the Intervention Materials

Participants were asked to evaluate the intervention materials they reported that they were exposed to. Table 5 reports the number of students, who reported to be exposed to the intervention materials, as well as how personal relevant the messages were, how much students liked the materials, how much the messages motivated them to attend PASS, and if they would like to receive them in the near future.

[INSERT TABLE 5 ABOUT HERE]

A high number of students that took part in the interventions stated that they were exposed to the intervention materials employed in Curtin University (except for the business card, which was omitted from the following interventions). At University of Wollongong, similarly high number of exposures was found for the emails and lecture slides, however, the messages on the LMS were lower. This can be explained by some issues that were encountered accessing the LMS at University of Wollongong. There were some difficulties meeting the



schedule in a timely matter because the LMS at University of Wollongong is managed by the Faculty. Nevertheless, on average, the students reported to be neutral to positive on all evaluation measures.

#### **4.3 PASS Attendance Compared to Previous Years**

Figure 4 displays the average number of attendees per PASS session in semesters 1 and 2 of 2016 and 2017 at Curtin University and in semester 2 of 2016 and 2017 at University of Wollongong.

[INSERT FIGURE 4 ABOUT HERE]

It illustrates that PASS attendance at Curtin University was 16.3% higher in semester 1 of 2017 compared to semester 1 of the previous year. However, a semester 2 comparison shows a similar (14.4%) decrease from 2016 to 2017. No overall change in the average number of attendees per session at University of Wollongong between 2016 and 2017 was observed.

### **5.0 Discussion**

The purpose of this study was threefold: first, we aimed to test the predictability of the TPB on PASS attendance by testing whether the theory can predict PASS attendance and subsequently students' academic performance. Secondly, the study aimed to assess the role of students' academic motivation within the TPB; i.e., can motivation predict PASS attendance and close the intention-behaviour gap as well as can motivation directly predict students' academic performance as found in previous studies (Allen et al., 2017; Dawson et al., 2014; McGee, 2005). Thirdly, this study aimed to test whether students' testimonials based on the TPB framework (i.e., the intervention) can improve PASS attendance and subsequently improve students' academic performance. The results of each aim will be discussed in sequence below.

#### **5.1 The Predictability of the Theory of Planned Behaviour on PASS Attendance**

The data revealed that attitudes, subjective norm and perceived behavioural control at the beginning of the semester were significantly associated with intention to attend PASS that semester. Together, all three predictors explained 58% of the variance in intention. Intention and perceived behavioural control at the start of the semester significantly predicted PASS attendance, explaining 16% of total variance. This shows that first year undergraduate university students across Australia are most likely to attend PASS if they believe that PASS attendance is beneficial (attitudes), that attendance is a normative behaviour (subjective norms), and that attendance is under their control (perceived behavioural control). All indirect effects in the model were significant, indicating that the effects of these beliefs on attendance were mediated by behavioural intentions in a manner consistent with the TPB (Ajzen, 1991).

Previous studies have not tested these indirect relationships, with the exception of Allen et al. (2017), who tested TPB in a smaller sample at one university. Therefore, these findings add to the literature that support the TPB as a model of study behaviours in general (Ajzen & Madden, 1986; Moss, Hamilton, White, & Hansen, 2015), and PASS attendance specifically (Allen et al., 2017; White et al., 2011; White et al., 2008). Furthermore, this study extends the predictability of TPB to not only predict PASS attendance, but also the actual related outcome (academic performance in final grade).

## **5.2 The Role of Students' Academic Motivation within the Theory of Planned Behaviour**

Academic motivation predicted students' academic performance, replicating McGee (2005). It appears that students who reported to be more intrinsically motivated to study achieved higher grades compared to students who reported to be more externally motivated. Academic motivation, together with PASS attendance, explained a small but significant 4.5% of variance in academic performance. In line with previous research, the findings further revealed an intention-behaviour gap with more than 80% of variance unaccounted for in PASS attendance. In contrast to our expectations, the inclusion of academic motivation did not close this gap, nor did it moderate the relationship between PASS attendance and students' academic performance. Academic motivation was measured on a continuum from amotivation to external to intrinsic motivation based on the theory of self-determination (Deci & Ryan, 2011). Most students reported to be autonomous driven to study; they studied because they valued future career goals (identified motivation), found pleasure in broadening their knowledge and accomplishing achievements (intrinsic motivation). Fewer students studied for external non-autonomous motivators, which is in line with other research (e.g., Puklek Levpušček & Podlesek, 2019). Internal motivation is situational, personal and culturally specific (Ryan & Deci, 2020). Social and cultural influences on academic motivation seem to be limited in Australia (McInerney, Hinkley, Dowson, & Van Etten, 1998), however, it is possible students could be highly intrinsically motivated to attend university in general but not for a course they are taking for which they were offered to attend PASS (i.e., specificity of the measure). Future research may need to specify the academic motivation measure, matching the course that offers PASS, to assess whether academic motivation moderates the intention-behaviour gap in PASS attendance.

Another possibility for why academic motivation did not moderate the intention-behaviour gap is that PASS may be too focused on the external aim of passing a course and receiving a higher grade, not on an intrinsic desire to learn. Given that students in our sample were mostly internally motivated, they may not be inclined to

engage in activities like PASS that are geared around external rewards rather than deep engagement in the subject matter for its own sake. Future intervention around increasing PASS attendance through academic motivation may need to include messages that target internal motivators of attending PASS. Additionally, it is likely that other factors than academic motivation are causal mechanisms moderating the intention-behaviour gap. It also seems likely that the unexplained variance between the intention to attend PASS and PASS attendance might be due to students' contextual constraints. Several students in our focus groups who did not regularly attend PASS, emphasised that time-constraints and other commitments often made it unable for them to attend the PASS sessions. Further research is needed to examine the practical barriers that may impact students' PASS attendance. It is important to investigate what factors moderate this the intention-behaviour gap in PASS attendance, as it can explain how we best can achieve behaviour change in students. Problematic is that mechanisms underlying behaviour change are not routinely conducted in primary studies or research syntheses (Hagger, Moyers, McAnally, & McKinley, 2020). Therefore, it is difficult to predict and test relevant factors that can explain and change PASS attendance.

### **5.3 The Intervention effects on PASS Attendance and Academic Performance**

Although the model successfully explained the PASS attendance and students' academic performance in our samples, their attitudes, subjective norms, perceived behavioural control and intentions did not increase between the pre- and post-intervention questionnaires. In fact, in most cases, students' scores on these variables decreased over time. It is possible that this was due to a ceiling effect pre-intervention, as suggested by the relatively high pre-intervention means in Table 3. There was relatively little room for students' PASS beliefs and intentions to increase over time. Furthermore, most of our sample were first year students, it is reasonable to assume that most had no previous contact with PASS and very limited knowledge of the program when asked to complete the pre-intervention questionnaire. As their experience with the program developed, their beliefs may have become more 'realistic', leading to reduced post-intervention PASS attendance beliefs and intentions. If so, this would be analogous to the 'response-shift bias' that can occur when students are asked to self-report their knowledge and skills before and after a learning experience (Howard & Dailey, 1979). This is, of course, a matter that requires further research. Such research may benefit from using a 'retrospective pre-test', as described by Sullivan and Haley (2009).

Even though the intervention materials were developed in consultation with student focus groups, students were neutral about the personal relevance of the messages and the messages did not increase motivation for future use of the materials. On the other hand, most students were successfully exposed to the intervention materials, and did not appear to dislike receiving regular "PASS Facts". It may be the case that messages on their own are not sufficient to elicit a change in attitudes, subjective norms, perceived behavioural control, or intent. This is in contrast to previous research (Kothe & Mullan, 2014; Sainsbury, Mullan, & Sharpe, 2013, 2015). However, the ineffectiveness of our interventions may be explained by the findings of Wakefield, Loken, and Hornik (2010). They reviewed mass media campaign interventions and found that they are more likely to be successful when multiple interventions are provided and the target behaviour is episodic (e.g., vaccination) rather than habitual or ongoing (e.g., PASS attendance). Active interventions have shown to be more successful than passive interventions in regards to habitual or ongoing health-related behaviours (Albarracín et al., 2005; Michie, Abraham, Whittington, McAteer, & Gupta, 2009). Albarracín et al. (2005) defined 'active' intervention programmes as those that required participants to practise a skill or partake in a health enhancing behaviour. Hence, future research into strategies to increase PASS attendance could focus on developing interventions that are more engaging (i.e., planning workshop, teaching time management skills) than the regular communication of passive messages.

Although the intervention did not appear to increase PASS attendance attitudes, subjective norms, perceived behavioural control or intentions, overall, per-session PASS attendance levels did increase by 16% between the first semester of 2016 and the first semester of 2017 at Curtin University. It is possible that the intervention influenced attendance, not through the mechanisms of change proposed by the TPB, but due to the increased exposure to information about PASS (including the pre-intervention questionnaire; Mankarious and Kothe (2015)). Another possibility is that other, more complex mechanisms related to other theoretical variables were targeted in the "PASS Facts". For instance, the facts possibly promoted autonomy support, and relatedness with PASS in a manner consistent with self-determination theory (Deci & Ryan, 2011; Ryan & Deci, 2000). This study only assessed academic motivation pre-intervention; it is suggested that further research also assesses it post-intervention to investigate whether the intervention changed the students' motivational perspectives to attend PASS.

Although first semester per-session PASS attendance levels at Curtin University increased between 2016 and 2017, the opposite occurred in second semester, when attendance dropped by 14%. It is possible that the increases and decreases we observed reflect normal year-on-year fluctuation. The absence of any year-on-year

change at University of Wollongong supports this proposition. The PASS programs at both universities rely on non-recurrent funding, and thus the number of sessions available to students each year fluctuates, which can contribute to variations in the number of sessions available to students, and thus attendance. Future research should investigate how session availability, timetabling and other factors external to PASS programs can influence attendance.

#### **5.4 Conclusion**

Related to the first aim of this study, the TPB seems to be a good model for predicting PASS attendance in undergraduate students and can be successfully extended to predict students' academic performance. Next, students who reported to be intrinsically motivated showed higher final unit grades compared to those who reported to be externally motivated. No evidence supported that academic motivation was the causal mechanism of PASS for increasing students' performance; academic motivation was not successful in closing the intention-behaviour gap. Future research could investigate other factors that can explain how PASS increases students' academic performance and that can close the intention-behaviour gap. Related to the third aim of this study, the intervention based on the TPB did not appear to increase PASS attendance attitudes, subjective norms, perceived behavioural control or intentions, overall per-session PASS attendance levels did increase by 16% between the first semester of 2016 and the first semester of 2017 at Curtin University, but then decreased in semester 2. No year-on-year change was found in per-session attendance at University of Wollongong. Although the intervention did not achieve its stated aims, its development and implementation extend the current knowledge related to PASS attendance and is a positive example of a successful collaboration between research and practice.

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Table 1

## Population and Sample Characteristics

University	Semester	Units <i>N</i>	Cohort <i>N</i>	Start <i>N</i>	Pre <i>N</i>	Post <i>N</i>	% Female	Age <i>M(SD)</i>
Curtin	1	19	6295	1507	934	566	66.0	21.8(6.2)
University	2	20	4345	547	462	136	60.6	23.0(5.9)
University of Wollongong	2	34	5421	758	691	237	63.2	21.3(5.9)

*Note: Curtin University refers to the first cite of intervention implementation, whereas University of Wollongong refers to the second cite of intervention implementation. Cohort N = the total size of each cohort. Units N = the number of units students were enrolled in. Start N = the number of students who started the pre-intervention questionnaire and subsequently provided useable pre- (Pre-N) and post-intervention (Post-N) data.*

Table 2

## Intervention Schedule

Week	Activity
0	Pre-intervention questionnaire
1	
2	
3	Email targeting attitude
4	Business cards targeting perceived behavioural control
5	LMS announcement targeting subjective norm
6	Email targeting perceived behavioural control
7	
8	Business cards targeting subjective norm
9	LMS announcement targeting attitude
10	Email targeting subjective norm
11	Lecture slide targeting attitude
12	LMS announcement targeting perceived behavioural control
13	
14	
15	Post-intervention questionnaire

*Note. LMS = Learning Management System. The length of the intervention and ordering of events remained the same across semesters and universities. However, some breaks shifted to coincide with non-teaching weeks.*

Table 3

Descriptive Statistics, Cronbach's Alpha's ( $\alpha$ ) and Zero-Order Correlations for Attendance Behaviour and the TPB

Constructs Measured Pre-Intervention

	<i>M</i>	<i>SD</i>	<i>a</i>	2	3	4	5	6	7
1. Attitude	5.37	.821	.914	.597***	.353***	.692***	.328***	.201***	.017
2. Subjective norm	4.84	.896	.747	-	.328***	.587***	.257**	.079*	.039
3. PBC	4.96	1.11	.827		-	.510***	.133***	.258***	.087*
4. Intention	5.19	1.34	.900			-	.248***	.353***	.090**
5. Academic Motivation	21.3	8.73	.893				-	.070*	.152***
- Internal (to know)	5.72	1.08	-						
- Internal (accomplish)	5.28	1.26	-						
- Internal (stimulate)	3.97	1.48	-						
- External (identified)	5.92	.907	-						
- External (introjected)	4.96	1.43	-						
- External (external)	5.26	1.36	-						
- Amotivated	1.70	1.08	-						
6. PASS attendance	27.3	40.9	-					-	.150***
7. Unit grade	72.4	17.5	-						-

*Note.* The latent variables that were used in the models are correlated (this does not include the sub-scales of academic motivation). PBC = Perceived Behavioural Control. Curtin University refers to the first cite of intervention implementation, whereas University of Wollongong refers to the second cite of intervention implementation. The same table for post-intervention measures can be found on: <https://osf.io/pn347/>.

\*\*  $p < .01$ , \*\*\*  $p < .001$  (two-tailed).

Table 4.

Regression Coefficients for the Sub- and Final Models

Sub-Models	Intention		PASS Attendance		Unit grade	
	Est.(SE)	Z	Est.(SE)	Z	Est.(SE)	Z
Attitude	.787(.050)	15.6***				
Subjective norm	.342(.042)	8.20***				
PBC	.331(.032)	10.5***	3.63(1.18)	3.07**		
Intention			8.51(.908)	9.37***	.501(.581)	.861
Motivation			.483(.493)	.980	.290(.067)	3.96***
Intention*Motivation			-.115(.096)	-1.20		
Attendance					.091(.035)	2.59**
Motivation*Attendance					-.001(.002)	-.918
Final Model	Intention ( $R^2 = .582$ )		PASS Attendance ( $R^2 = .155$ )		Unit grade ( $R^2 = .045$ )	
	Est.(SE)	Z	Est.(SE)	Z	Est.(SE)	Z
Attitude	.716(.047)	15.2***				
Subjective norm	.341(.042)	8.03***				
PBC	.335(.029)	11.5***	4.69(1.36)	3.45**		
Intention			9.53(1.13)	8.44***		
Academic motivation					.290(.068)	4.30***
Attendance					.061(.014)	4.26***

Note: Explained variance ( $R^2$ ) is shown for each outcome variable in the final model, whereas a regression coefficient estimates (Est.), standard error (SE) and the Z-value (i.e., Wald statistic (Est./SE)) are shown for each predictor variable in the a-prior and final model. PBC = perceived behavioural control

Table 5

## Intervention Evaluation Descriptive Statistics

		Exposure <i>N</i> (%)	Personal relevance <i>M</i> ( <i>SD</i> )	Valence <i>M</i> ( <i>SD</i> )	Motivation <i>M</i> ( <i>SD</i> )	Future interest <i>M</i> ( <i>SD</i> )
Curtin University (Semester 1)	<i>LMS</i>	471(83.4%)	3.24(0.97)	3.53(0.63)	3.59(1.78)	3.58(1.60)
	<i>Email</i>	493(87.1%)	3.21(1.11)	3.47(0.69)	3.62(1.88)	3.92(1.81)
	<i>Slide</i>	459(81.2%)	3.24(1.12)	3.55(0.69)	3.47(1.53)	3.66(1.75)
	<i>Card</i>	298(53.7%)	2.82(1.67)	3.39(0.75)	2.79(1.52)	4.43(1.92)
Curtin University (Semester 2)	<i>LMS</i>	137(82.0%)	3.50(0.96)	3.65(0.62)	3.92(1.72)	3.27(1.70)
	<i>Email</i>	148(88.1%)	3.40(1.02)	3.57(0.71)	3.79(1.75)	3.66(1.75)
	<i>Slide</i>	127(77.0%)	3.46(1.02)	3.57(0.70)	3.71(1.52)	3.56(1.56)
University of Wollongong	<i>LMS</i>	142(58.4%)	3.41(1.18)	3.74(0.66)	4.04(1.85)	3.35(1.73)
	<i>Email</i>	189(77.8%)	3.32(1.15)	3.55(0.62)	3.70(1.91)	3.95(1.79)
	<i>Slide</i>	206(84.8%)	3.59(1.14)	3.71(0.66)	3.83(1.57)	3.38(1.79)

*Note.* *M* = mean, *SD* = standard deviation. Curtin University refers to the first cite of intervention implementation, whereas University of Wollongong refers to the second cite of intervention implementation. In all instances, higher scores reflect a more positive disposition to the message type.

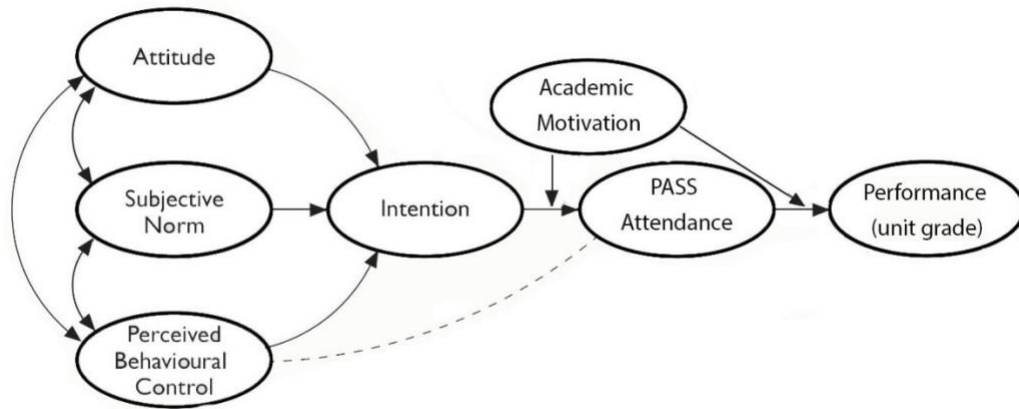


Fig. 1. A-Priori Model

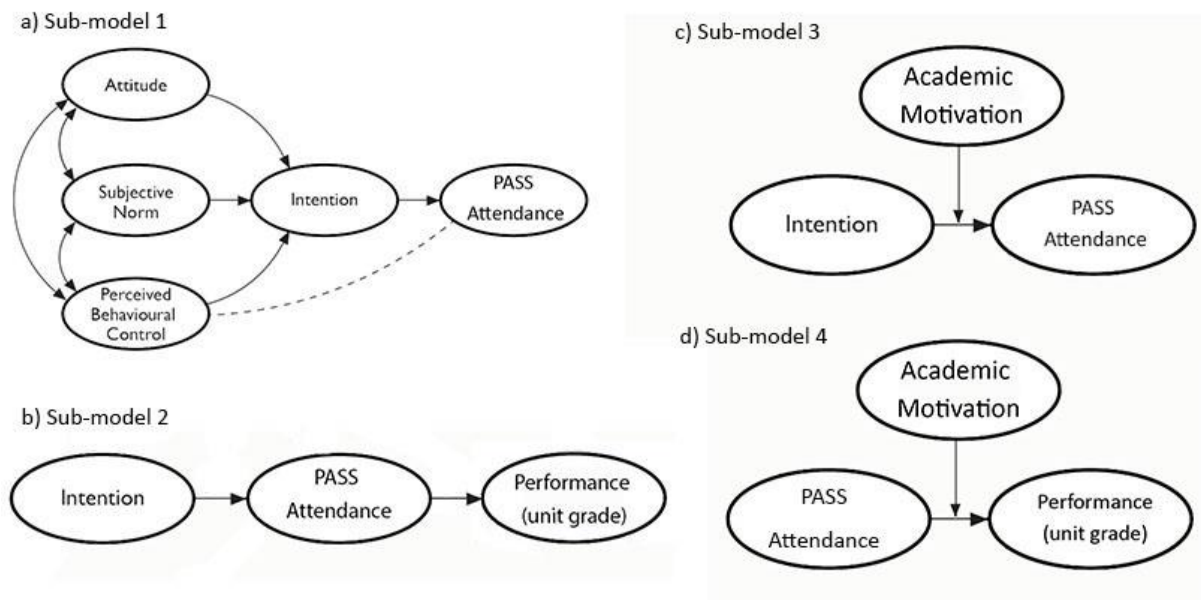
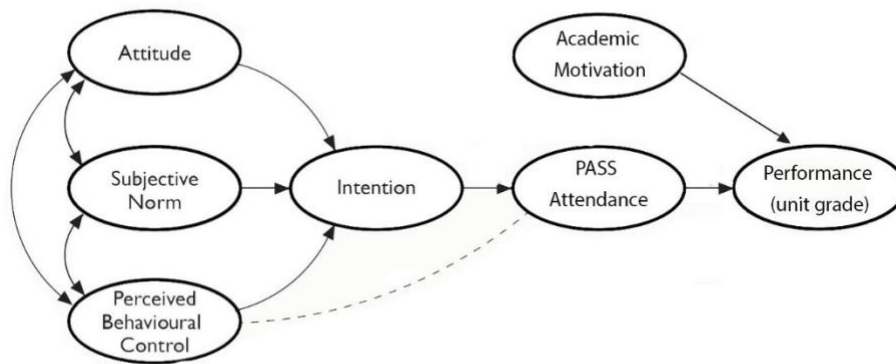
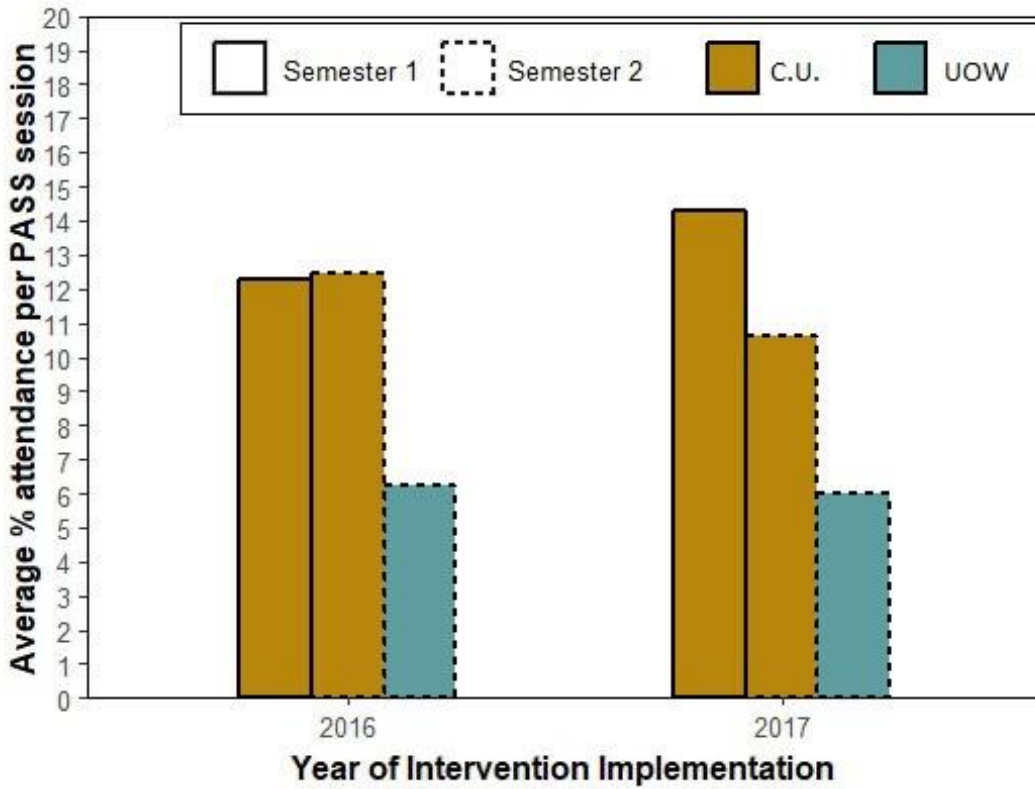


Fig 2. Sub-Models



**Fig. 3.** *Final model*





**Fig. 2.** Average number of attendees per PASS session at the two universities in 2016 and 2017. Curtin University (C.U.) refers to the first cite of intervention implementation, whereas University of Wollongong (UOW) refers to the second cite of intervention implementation. At Curtin University the intervention was implemented in both semesters of 2017. At University of Wollongong it was only implemented in semester 2 of 2017.