

## ARTICLE

# Using a volitional help sheet to increase university students' attendance at synchronous online lectures: A randomized controlled trial

Mark A. Elliott  | Allan McGroarty  | David J. Robertson 

Department of Psychological Sciences and Health, University of Strathclyde, Glasgow, UK

**Correspondence**

Mark A. Elliott, Department of Psychological Sciences and Health, University of Strathclyde, 40 George Street, Glasgow G1 1QE, UK.  
Email: [mark.a.elliott@strath.ac.uk](mailto:mark.a.elliott@strath.ac.uk)

**Abstract**

**Background:** A volitional help sheet (VHS) is an intervention for promoting implementation intentions. This study was the first to test the effectiveness of a VHS for increasing university students' lecture attendance.

**Aims:** To develop a VHS to increase university students' lecture attendance and test its effectiveness at increasing the proportion of lectures attended, and promoting the maintenance of lecture attendance, over an 11-week teaching semester.

**Sample and Method:** One hundred and seventy-eight undergraduate students enrolled in a psychology degree programme were allocated at random to a VHS or active control condition. Prior to intervention, measures of goal intention to attend lectures and trait conscientiousness were collected using self-report, online questionnaires. Over the following 11-week teaching semester, attendance at synchronous (live) online lectures was measured.

**Results:** The VHS condition attended a greater proportion of lectures and maintained their lecture attendance for longer than did the active control condition. These effects were not sensitive to underlying goal intentions, although the sample means on the measures of goal intention were approaching ceiling. Trait conscientiousness increased the effects of the VHS on the proportion of lectures attended.

**Conclusions:** VHSs constitute useful interventions for increasing and maintaining university students' lecture attendance.

**KEYWORDS**

conscientiousness, goal intention, implementation intentions, lecture attendance, maintenance of behaviour, volitional help sheet

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## INTRODUCTION

Synchronous (live) lectures remain the predominant mode of teaching in most higher education courses (Goffe & Kauper, 2014; Watts & Schaur, 2011). They are associated with valued pedagogical objectives including the acquisition of information, particularly conceptual knowledge, the development of critical thinking, and the promotion of interest and enthusiasm for subjects (e.g., Charlton, 2006; Webster, 2015). Research has shown that attendance at synchronous lectures is associated with better academic performance and other (e.g., social) benefits (e.g., Credé et al., 2010; Edwards & Clinton, 2019; Louis et al., 2016; Romer, 1993; Tokumitsu, 2017; Trice et al., 2000; Wongtrakul & Dangprapai, 2020). However, attendance rates are typically found to be low, often around 50% (e.g., Beovich et al., 2021; Hollett et al., 2020; Skead et al., 2020; Williams, 2022) and as low as 30% (Moore et al., 2008). Interventions that promote lecture attendance are therefore important.

Researchers and educational practitioners have assessed the effects of various interventions on lecture attendance rates: making lecture attendance mandatory (e.g., Marburger, 2006), the utility of rewards and penalties (e.g., Moore, 2005), and the use of new technologies (e.g., lecture capture) to help provide access to lectures if students are unable to attend (e.g., Walker et al., 2014). However, these interventions can be costly, impractical, or ineffective (e.g., Conrad, 2004; Lamb et al., 2020; Shapiro, 1994). They can also undermine educational principles, including the promotion of student disengagement in lectures or learning strategies that lead to poorer student performance (e.g., Edwards & Clinton, 2019; Schnee et al., 2019). We therefore developed and tested an intervention to increase students' attendance at synchronous lectures that would be cost-effective, practical to implement, and grounded in established psychological theory. The study was carried out during the 2021–22 academic session when lectures were still being delivered online as a continued response to the COVID-19 pandemic. This afforded the opportunity to employ objective outcome measures of attendance at synchronous lectures, using online attendance records. This had the advantage over subjective (self-report) measures, which are susceptible to cognitive (e.g., Luchins, 1957), affective (e.g., Bower, 1992), and self-presentational biases (e.g., Podsakoff et al., 2003).<sup>1</sup> The intervention that was developed and tested was a volitional help sheet (VHS; Armitage, 2008).

A VHS (Armitage, 2008) is an intervention that converts goal-intentions (e.g., “I intend to attend my lectures this semester”) into action through the promotion of implementation intentions (IF–THEN plans; Gollwitzer, 1993). It provides a list of pre-specified critical situations that put an intended behaviour (e.g., attending a lecture) at risk. These critical situations are presented as IF statements (e.g., ‘IF I am tempted to miss a lecture because I have a university deadline approaching’). It also contains a list of pre-specified goal-directed responses (strategies) that can be used to manage the critical situations. The goal-directed responses are presented as THEN statements (e.g., THEN I will remind myself that attending lectures should help me get a higher mark). Recipients of a VHS are asked to form implementation intentions by selecting the IF statements that correspond to the critical situations will put at risk their performance of an intended behaviour, and linking each one with a THEN statement. Subsequently, these implementation intentions help ensure goal-intended behaviour by increasing the salience of the selected critical situations when they are encountered (e.g., Milne et al., 2002; Webb & Sheeran, 2004) and automatically initiating the linked goal-directed response (e.g., Brandstätter et al., 2001; Orbell & Sheeran, 2000; Webb & Sheeran, 2004). As a result, they help overcome self-regulatory problems that stop people from enacting their goal intentions such as missing opportunities to act or getting tempted by alternative courses of action (Sheeran & Webb, 2016).

<sup>1</sup>Note that many online courses employ asynchronous lectures. These are recordings of lectures that are made prior to delivery (e.g., in a studio). The recordings are subsequently made available to students (e.g., through a virtual learning environment). A discussion of the potential advantages and disadvantages of synchronous and asynchronous lectures is outside the scope of this article. However, timetabled synchronous lectures that are delivered online are akin to on-campus lectures in that they require students to “turn up” for scheduled teaching, thus helping to ensure the same educational benefits that come from appropriate spacing of learning and the ability to interact with a lecturer in real-time. This study was concerned with testing an intervention to promote attendance at synchronous, not asynchronous, lectures that, out of necessity were delivered online. We return to this issue in the discussion.

VHSs have been found to increase smoking cessation (Armitage, 2008), physical activity (e.g., Armitage & Arden, 2010) and weight loss (e.g., Armitage et al., 2017). They have also been found to reduce alcohol consumption (e.g., Arden & Armitage, 2012; Armitage & Arden, 2012), driving speed (e.g., Brewster et al., 2015, 2016), mobile phone use while driving (e.g., Elliott et al., 2021), and self-harm (e.g., Armitage et al., 2016; Paterson et al., 2023). However, no previous studies have tested whether VHSs can increase university students' lecture attendance. Despite this, there are several reasons why a VHS is likely to be effective for this behaviour. First, sample means on measures of goal intentions to attend university lectures tend to be high (e.g., Hollett et al., 2020; Skoglund et al., 2020; Webb et al., 2007). University lecture attendance is therefore a goal-intended behaviour. Second, in spite of these goal intentions, lecture attendance rates tend to be low (see above) and it has been found that goal intentions account for just 7% of the variance ( $r = .27$ ) in actual lecture attendance (Hollett et al., 2020). Therefore, consistent with other behaviours (e.g., Sheeran, 2002; Webb & Sheeran, 2006), there is a gap between many university students' positive goal intentions to attend lectures and their behaviour, meaning that an intervention is required that can help students translate their goal intentions into action. Third, university students give many reasons for missing lectures, such as feeling tired, having access to lecture materials that provide the information from the lecture (notes or recordings), and work commitments (e.g., Bati et al., 2013; Moore et al., 2008; Skead et al., 2020). These reasons constitute critical situations that put the required behaviour at risk. A VHS is likely to provide effective goal-directed strategies for managing such situations, thus increasing the translation of the required goal intentions into action.

Previous research also provides promising evidence that implementation intentions can increase university lecture attendance. Webb et al. (2007) found that students randomized to an experimental condition, and asked to specify implementation intentions ( $n = 53$ ), subsequently had an 83% lecture attendance rate. In comparison, students randomized to a control condition ( $n = 47$ ) had just a 69% attendance rate. Trait conscientiousness also moderated the effect of implementation intentions with higher attendance rates in the implementation intention condition being observed at low (mean  $-1SD$ ) and moderate (mean), but not high (mean  $+1SD$ ), levels of trait conscientiousness. Implementation intentions were therefore more effective at promoting lecture attendance in students who were most likely to suffer self-regulatory problems (Webb et al., 2007). However, the participants in Webb et al.'s study formed *self-generated* rather than VHS-generated implementation intentions. While research has shown that self-generated implementation intentions are effective at modifying behaviour (e.g., Gollwitzer & Sheeran, 2006; Malaguti et al., 2020), they can often comprise poorly specified critical situations and goal-directed responses (Elliott & Armitage, 2006). They can also lack adherence to the IF-THEN planning format (Snihotta, 2009), which compromises their ability to generate behaviour-change (Armitage, 2008; Oettingen et al., 2000). VHSs overcome these problems by providing participants with well-specified, evidence-based critical situations and goal-directed responses, in an IF-THEN format. Given also that Webb et al. (2007) is the only previously published study of implementation intentions in the context of university lecture attendance (Open Science Collaboration, 2015), the first aim of this study was to develop and test the first VHS for targeting this behaviour.

The present study also extended Webb et al. (2007) in two other key ways. First, an active rather than a passive control condition was used. As is the case in many studies, the control condition in Webb et al. (2007) received no intervention. Therefore, the observed increases in lecture attendance rates in the experimental condition could have been due to a demand effect (e.g., Weber & Cook, 1972). In studies of VHSs, demand effects can be ruled out by providing the control condition with the same content as the experimental condition but without an instruction to link the selected provided critical situations with goal-directed responses (e.g., Armitage, 2008; Armitage & Arden, 2010, 2012). This ensures that any post-intervention difference in behaviour (e.g., lecture attendance) between conditions is a result of forming an implementation intention (i.e., linking critical situations with goal-directed responses) rather than being exposed to critical situations and goal-directed responses only.

Second, we tested the extent to which the VHS promoted lecture attendance using a measure of behavioural maintenance in addition to a summative measure of attendance. Research shows that lecture attendance rates tend to drop from their initial levels, as the academic semester progresses

and increase again at the end of semester as students approach the final assessment period (e.g., Skead et al., 2020). However, research testing the effects of interventions (e.g., Webb et al., 2007) tends to rely on outcome measures of lecture attendance across an entire teaching semester or academic year (also see Dickson & Stephens, 2016). This ignores variations in attendance rates across the semester, which are important because sustained attendance at lectures incurs educational benefits that are less well afforded by a sporadic or bipolar distribution of attendance. This includes the promotion of regular and spaced learning, greater critical understanding, long-term retention of knowledge, and the reduced need for cramming practices (e.g., House et al., 2017; Kim & Seo, 2016). It is important, therefore, that interventions not only increase attendance rates, overall, but also the maintenance of attendance. More generally, maintenance is regarded as an important phase in the process of behaviour-change (e.g., Kwasnicka et al., 2016; Prochaska & DiClemente, 1983). This phase indicates that a new, desired pattern of behaviour (e.g., lecture attendance) has come to dominate the old, undesired one (e.g., lecture absenteeism). While some studies (e.g., Armitage et al., 2016; Conner & Higgins, 2010) have shown that implementation intentions can generate longer term (6 months plus) behaviour-change, they tend to use summative measures of behavioural frequency as dependent variables (e.g., how often a behaviour has been performed overall during the last  $N$  months) rather than direct measures of behavioural maintenance (e.g., Armitage, 2005). In this study, we addressed this gap using a longitudinal design to test the number of weeks that university students maintain their lecture attendance before absenteeism.

## The present study

Consistent with the above review, we hypothesised that university students who received a VHS would attend a greater proportion of synchronous online lectures over the course of an 11-week teaching semester than would students in an active control condition (*hypothesis 1*). We also hypothesised that they would maintain their lecture attendance for longer (*hypothesis 2*). Given that implementation intentions increase goal-intended behaviour, we also hypothesised that the effects of the VHS on the proportion of synchronous online lectures attended and the maintenance of lecture attendance would increase with goal intentions to attend lectures (*hypothesis 3*). Finally, in line with Webb et al. (2007), we hypothesised that the effects of the VHS on the proportion of synchronous online lectures attended and the maintenance of lecture attendance would decrease with trait conscientiousness (*hypothesis 4*).

## METHOD

### The participants

The sample comprised  $N=178$  university students enrolled in a 4-year, undergraduate, Psychology degree programme at a large University in the West of Scotland (see Figure 1 for the CONSORT flow chart). The participants were in either year 2 (49.4%), year 3 (39.1%), or year 4 (10.7%). The mean age of the sample was 21.90 years old ( $SD=6.34$ ; range = 18 to 61; 84% females). Forty-seven percent of the sample was in the first class mark range (mean class mark of 70%+ in the preceding academic year), 40% were in the second class upper division range (mean mark of 60% to 69%), 12% were in the second class lower division range (mean mark of 50% to 59%), and 1% in the third class range (mean mark of 40% to 49%). The overall attendance rate at the synchronous online lectures was 54% (55% in year 2, 53% in year 3, and 50% in year 4).

Power analysis indicated that the sample provided sufficient power for the analyses (Power > .80; Cohen, 1992). At  $\alpha = .05$ ,  $d = .50$ , and  $n = 178$  ( $n = 89$  in the VHS condition and  $n = 89$  in the active control condition), Power = .95.

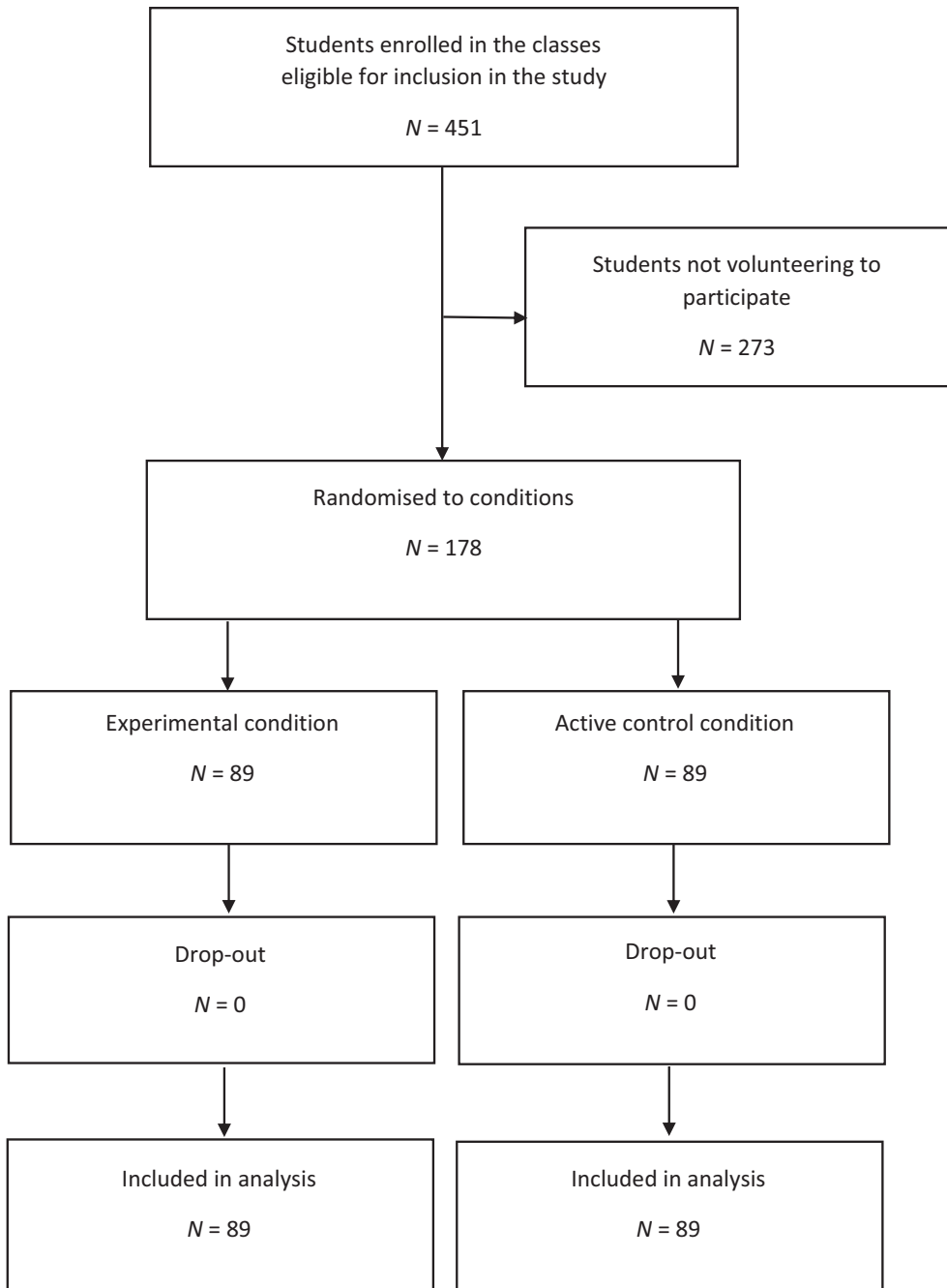


FIGURE 1 CONSORT flow chart.

## Design and procedure

Randomized-controlled design. The participants were sampled from classes in which synchronous, rather than asynchronous, lectures were being delivered online, using Zoom, as a continued response to the COVID pandemic. The participants were sampled from one compulsory (i.e., non-elective) class

in both years 2 and 3, and one optional (i.e., elective) class in year 4.<sup>2</sup> No classes in year 1 were used because they deployed asynchronous lectures. Each class took place within an 11-week teaching semester, following an introduction and development week, during the 2021–22 academic session. The year 2 class comprised two lectures per week. The year 3 class comprised three lectures per week. The year 4 class comprised one lecture per week. The classes in years 2 and 4 of the degree programme took place during the first teaching semester of the academic year (September to December). The class in year 3 of the degree programme took place during the second teaching semester of the academic year (January to April).

During the introduction and development week, students in each class were sent an advertisement through the University's virtual learning environment. The advertisement contained a link to an online questionnaire, which took approximately 5 min to complete. The questionnaire was designed and administered using Qualtrics. At the start of the questionnaire, the participants were given an information sheet and consent form. The information sheet explained that the study was an investigation into how it might be possible to increase student lecture attendance. The participants who consented to participate were asked for their first and last names to enable their questionnaire data to be matched with information about their lecture attendance (held in Zoom), and their age, sex, level of study, and their academic performance in previous years (held on their official university record).

Next, the participants were presented with standard items to measure goal intentions to attend lectures over the course of the proceeding academic semester and trait conscientiousness. After completing these items, they were allocated at random to receive either a VHS or control intervention, embedded at the end of the questionnaire. The participants allocated to the VHS condition ( $n = 89$ ) were presented with a drop-down list of 20 critical situations that tapped reasons that are commonly given by students for missing lectures (e.g., Bati et al., 2013; Moore et al., 2008; Skead et al., 2020). Each critical situation was presented as an IF statement (e.g., "If I am tempted to miss a lecture because I have a university deadline approaching..."; see Appendix A for the full list). The participants were asked to select the situation that they thought would tempt them the most to miss a lecture over the coming semester. The participants were then presented with a drop-down list of 24 goal-directed responses. Consistent with VHSs developed in previous research on other social behaviours (e.g., Armitage, 2008; Armitage et al., 2016; Brewster et al., 2015), these were based on Prochaska and DiClemente's (1983) processes of behaviour-change. Each goal-directed response was presented as a THEN statement (e.g., "...Then I will remind myself that attending lectures should help me get a higher mark"; see Appendix B for the full list). The participants were asked to select the goal-directed response that they would try to employ should they find themselves in their selected critical situation over the coming semester. The selected IF and THEN statements were combined and presented as a single IF–THEN statement (i.e., an implementation intention). The participants completed this task three more times, thus forming a total of four implementation intentions. They were also asked to read each of the four IF–THEN statements after linking each critical situation with a goal-directed response.

The participants allocated to the active control condition ( $n = 89$ ) were also presented with the same critical situations and goal-directed responses but without making links between the two. Instead, they were asked to select four critical situations that they thought would be most likely to tempt students to miss a lecture and, separately, four goal-directed responses that most students would find effective for avoiding the temptation.

Over the proceeding 11 weeks, information about lecture attendance was extracted from Zoom records. Information about age, sex, year of study, and degree classification level were extracted from

<sup>2</sup>Note that all Psychology classes in years 2 and 3 formed a compulsory part of the curriculum, meaning that the entirety of years 2 and 3 were included in the sampling procedure. Also note that year 4 of the degree programme contained optional (elective) classes only and the one selected for this research was the largest in which the students received synchronous lectures.



official university records. Once this information was merged with the questionnaire data, the participants were debriefed and the data were anonymised.

## MEASURES

### Goal intentions

Goal intentions to attend lectures were measured in the questionnaire with four standard items (Fishbein & Ajzen, 2010). The participants responded to all items using 9-point scales (e.g., 'How many lectures do you intend to go to this semester?' *None of them* [scored 1] to *All of them* [scored 9]). The arithmetic mean of the four items was used as the final measure of goal intention ( $\alpha = .71$ ).

### Trait conscientiousness

Trait conscientiousness was measured in the questionnaire with 10 items from the International Personality Item Pool (Goldberg, 1999). The participants were asked to 'indicate how accurately each of the following statements describe you', using 5-point scales (e.g., 'I am always prepared' *Very inaccurate* [scored 1] to *Very accurate* [scored 5]). The arithmetic mean of the 10 items was used as the final measure of trait conscientiousness ( $\alpha = .86$ ).

### Lecture attendance measures

Attendance was recorded in Zoom for each synchronous online lecture (0 = did not attend and 1 = did attend). The final measures of lecture attendance were the proportion of synchronous online lectures that were attended over the course of the semester and the number of weeks that the participants maintained their attendance (i.e., before absenteeism from a lecture).

## RESULTS

### Tests of randomisation

A series of one-way ANOVAs and chi-squared tests determined whether there were any differences between the VHS and active control conditions prior to intervention. The dependent variables in the ANOVAs were as follows: goal intention (ANOVA 1), trait conscientiousness (ANOVA 2), and age (ANOVA 3). The independent variable in each analysis was condition (0 = active control; 1 = VHS). The variables in the chi-squared tests were condition by sex (test 1), condition by academic year of study (test 2), and condition by degree classification. There were no significant differences between the conditions on any measure (see Table 1). Randomisation to the conditions was therefore successful.

### Descriptive statistics

The participants in each condition had extremely positive goal intentions towards attending lectures and were moderately conscientious (see Table 1). On average, 49% of the synchronous online lectures were attended by the participants in the active control condition and 58% were attended by the participants in the VHS condition.

TABLE 1 Descriptive statistics and tests of difference between the conditions.

	CONT	VHS	Tests of difference
Proportion of lectures attended	Mean (SD) 49.04 (32.91)	58.10 (35.54)	$F (df=4, 173) = 4.82, MSE = 0.10, p = .029, d = 0.32^a$
Goal intention (scale range: 1 to 9)	Mean (SD) 8.33 (0.86)	8.27 (1.04)	$F (df=1, 176) = 0.17, MSE = 0.92, p = .681, d = -0.06^b$
Trait conscientiousness (scale range: 1 to 5)	Mean (SD) 3.57 (0.67)	3.50 (0.67)	$F (df=1, 176) = 0.49, MSE = 0.45, p = .484, d = -0.10^b$
Age	Mean (SD) 22.34 (6.48)	21.46 (6.20)	$F (df=1, 176) = 0.85, MSE = 40.22, p = .358, d = -0.14^b$
Sex			
Males	$n$ (%) 16 (18.0)	13 (14.6)	$\chi^2 (df=1) = 0.37, p = .543, \phi = 0.05^c$
Females	$n$ (%) 73 (82.0)	76 (85.4)	
Academic year of study			
2nd year UG	$n$ (%) 43 (48.3)	45 (50.6)	$\chi^2 (df=2) = 0.23, p = .894, V = 0.04^c$
3rd year UG	$n$ (%) 37 (41.6)	34 (38.2)	
4th year UG	$n$ (%) 9 (10.1)	10 (11.2)	
Degree classification			
First Class	$n$ (%) 42 (47.7)	40 (47.6)	$\chi^2 (df=3) = 2.22, p = .529, V = .11^c$
Second Class Upper Division	$n$ (%) 35 (39.8)	33 (39.3)	
Second Class Lower Division	$n$ (%) 11 (12.5)	9 (10.7)	
Third Class	$n$ (%) 0 (0.00)	2 (2.4)	

*N* = 230. CONT = Active control condition. VHS = Volitional help sheet condition.

<sup>a</sup>ANCOVA with the correlates of lecture attendance (age, goal intention and conscientiousness) used as covariates.

<sup>b</sup>ANOVAs.

<sup>c</sup>Chi-squared tests.



TABLE 2 Correlation matrix.

Variable	<i>r</i>						
	1.	2.	3.	4.	5.	6.	7.
1. Proportion of lectures attended	—	.30***	.17*	.16*	-.08	-.05	-.13
2. Goal intention		—	.28***	.05	.27***	-.09	-.09
3. Trait Conscientiousness			—	.05	.22**	-.08	-.13
4. Age				—	-.11	.21**	.12
5. Sex					—	.11	-.11
6. Year of Study						—	.13
7. Degree Classification							—

Note: \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

## Effects of the VHS on lecture attendance

A one-way ANCOVA was conducted to test hypothesis 1: that the VHS condition would attend a greater proportion of the synchronous online lectures than would the active control condition. The dependent variable was the proportion of synchronous online lectures attended. The independent variable was condition (0 = active control; 1 = VHS). Age, goal intention, and trait conscientiousness were included as covariates because they were correlated significantly with the dependent variable (see Table 2). In support of hypothesis 1, the difference between the conditions was statistically significant (see Table 1). The estimated marginal means showed that the VHS condition attended a greater proportion of synchronous online lectures (adjusted  $M = 58.90$ ,  $SE = 3.43$ ) than did the active control condition (adjusted  $M = 48.23$ ,  $SE = 3.43$ ).

Survival analysis techniques were used to test the second hypothesis: that the VHS condition would maintain lecture attendance for longer than would the active control condition. First, a Kaplan–Meier analysis tested the univariate effects of condition on the maintenance of lecture attendance (i.e., survival). Figure 2 shows that the cumulative probability of lecture attendance dropped in both conditions as the semester progressed. However, the rate at which it dropped was slower in the VHS condition, meaning that the VHS condition was associated with greater maintenance of attendance at the synchronous online lectures than was the control condition,  $\chi^2$  (Log Rank,  $df = 1$ ) = 15.03,  $p < .001$ . By the end of week 1, 76% of the VHS condition had maintained its lecture attendance compared with 66% of the active control condition. By the end of week 4, the maintenance of lecture attendance was more than two times higher in the VHS than the control condition (55% vs. 25% maintenance rate). By the end of week 7, it was nearly three times higher (28% vs. 10% maintenance rate). By the end of week 11, maintenance in both conditions was low but it was nearly five times higher in the VHS condition (14% vs. 3%). Overall, the mean (5.31 vs. 3.48) and median (5.00 vs. 3.00) survival times showed that the VHS condition maintained its lecture attendance for approximately 2 weeks longer than did the active control condition, on average.

Second, a Cox regression tested the independent effects of condition on the time until first lecture absence, while controlling for age, goal intention and trait conscientiousness (i.e., the other variables significantly associated with lecture attendance; see Table 2). Consistent with the Kaplan–Meier analysis, Table 3 (see step 1) showed that condition (0 control; 1 = VHS) had a statistically significant independent effect on the hazard rate, with the VHS condition being associated with a larger shift down the hazard curve relative to the active control condition. The hazard ratio was .55, meaning that receiving the VHS was associated with a 45% decreased risk of non-attendance (i.e., increased maintenance of lecture attendance), at each time point. While unrelated to the hypotheses, it is noteworthy that goal intention was a significant independent predictor of the hazard rate, with higher intentions to attend lectures being associated with a 24% decreased risk of missing a lecture. Age and trait conscientiousness were not significant independent predictors of the hazard rate.

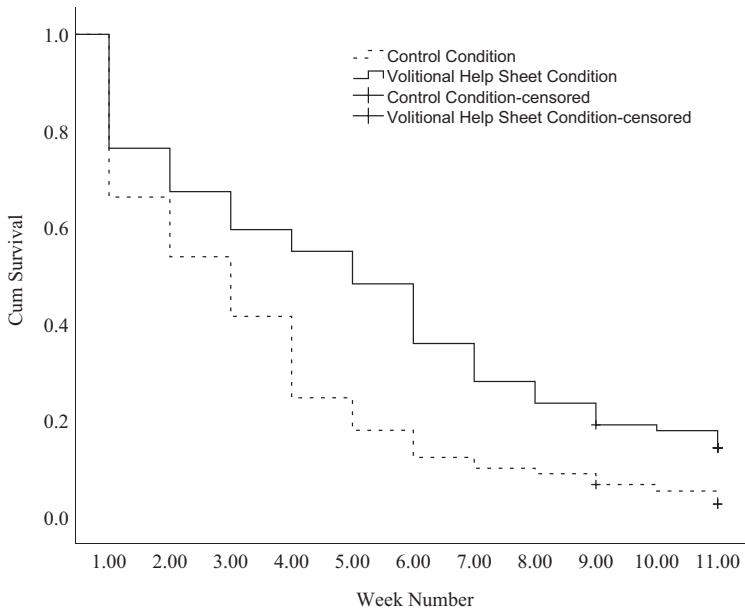


FIGURE 2 Kaplan–Meir survival curves for the maintenance of lecture attendance by condition.

TABLE 3 Cox regression predicting time to first lecture absence from condition, age, goal intention and trait conscientiousness (step 1), and the condition by goal intention and condition by trait conscientiousness interactions (step 2).

Step	Variable	-2LL	$\chi^2$	$p$ for $\chi^2$	<i>B</i>	<i>SE</i>	Wald	$p$ for <i>Wald</i>	Hazard ratio
1	Condition (0=CONT, 1=VHS)	1444.96	24.98	<.001	-.61	.16	13.79	<.001	0.55
	Age				-.02	.03	1.81	.179	0.98
	Goal Intention				-.27	.09	10.13	.001	0.76
	Trait Conscientiousness				-.02	.13	0.01	.905	0.99
2	Condition (0=CONT, 1=VHS)	1442.25	2.72	.257	-.61	.16	14.05	<.001	0.54
	Age				-.02	.01	2.77	.096	0.98
	Goal Intention				-.36	.13	8.11	.004	0.70
	Trait Conscientiousness				.14	.17	0.64	.425	1.15
	Condition × Goal Intention				.22	.18	1.48	.223	1.25
	Condition × Trait Conscientiousness				-.41	.27	2.29	.130	0.66

Note: CONT= Active control condition. VHS= Volitional help sheet condition.

### Moderation by goal intentions and trait conscientiousness

Hypotheses 3 and 4, that the effects of the VHS on attendance at synchronous online lectures will increase with goal intentions to attend lectures (hypothesis 3) and decrease with trait conscientiousness (hypothesis 4), were tested simultaneously in two analyses. The first analysis was a moderated linear regression (see Table 4). The dependent variable was the proportion of synchronous online lectures that were attended. The independent variables were condition (0=control, 1=VHS), goal intention, trait conscientiousness and the two-way interactions between condition and goal intentions and condition and trait conscientiousness. Age was also included as an independent variable given its significant association with lecture attendance (see Table 2). Consistent with standard procedures to reduce

**TABLE 4** Moderated linear regression predicting proportion of lectures attended from condition, age, goal intention, trait conscientiousness, and the condition by goal intention and condition by trait conscientiousness interactions.

Variable	$R^2$	$F$	$p$ for $F$	$\beta$	$t$	$p$ for $t$
Condition (0 = CONT, 1 = VHS)	.17	5.80	< .001	.16	2.25	.025
Age				.18	2.47	.015
Goal Intention				.37	3.35	.001
Trait Conscientiousness				-.07	-0.67	.504
Condition $\times$ Goal Intention				-.15	-1.34	.182
Condition $\times$ Trait Conscientiousness				.24	2.26	.025

Note: CONT = Active control condition. VHS = Volitional help sheet condition.

multicollinearity (Aiken & West, 1991), the continuous variables (goal intention and conscientiousness) were mean centred prior to calculating the 2-way interactions.

As Table 4 shows, the independent variables accounted for a significant percent of the variance in the proportion of synchronous online lectures that were attended. Consistent with the ANCOVAs, reported above, condition was a significant predictor; the standardized beta weight showed that the VHS condition attended a greater proportion of lectures than did the active control condition (see Table 4). Age and goal intention were also significant independent predictors; trait conscientiousness was not. The proportion of lectures that students attended increased with age and goal intentions. Contrary to hypothesis 3, the condition by goal intention interaction was not statistically significant. The condition by trait conscientiousness interaction was statistically significant. However, simple slopes analyses showed that, contrary to predictions, the effects of the VHS on the proportion of lectures attended increased, rather than decreased with conscientiousness. At low (mean  $-1SD$ ) levels of conscientiousness, condition was not a statistically significant predictor of the proportion of lectures attended ( $\beta = -.01$ ,  $t = -.09$ ,  $p = .925$ ). At moderate (mean) and high (mean  $+1SD$ ) levels of trait conscientiousness it was a statistically significant predictor (at moderate levels:  $\beta = .16$ ,  $t = 2.25$ ,  $p = .025$ ; at high levels:  $\beta = .33$ ,  $t = 3.17$ ,  $p = .002$ ).

The second analysis conducted to test hypotheses 3 and 4 was a Cox regression (see Table 3, step 2). Time to first lecture absence was predicted from the same independent variables used in the moderated linear regression. Contrary to hypotheses 3 and 4, the two-way interactions between condition and goal intention, and condition and trait conscientiousness, were not statistically significant.

## DISCUSSION

This study provided the first test of a VHS with regard to university lecture attendance. It was hypothesised that the VHS condition would attend a greater proportion of synchronous online lectures than would the active control condition (hypothesis 1). It was also hypothesised that the VHS condition would maintain its lecture attendance for longer than would the active control condition (hypothesis 2) and that the effects of the VHS on attendance at synchronous online lectures (both the proportion of lectures attended and the maintenance of lecture attendance) would increase with goal intentions (hypothesis 3) and decrease with trait conscientiousness (hypothesis 4).

In support of hypothesis 1, university students randomized to a VHS condition attended a significantly greater proportion of synchronous online lectures over the 11-week teaching semester than did students randomly assigned to a control condition (59% vs. 48%). These findings are consistent with previous studies of other behaviours, which have also shown that VHSs constitute a useful intervention for changing behaviour (e.g., Arden & Armitage, 2012; Armitage, 2008; Armitage et al., 2016, 2017; Armitage & Arden, 2010, 2012; Brewster et al., 2015, 2016; Elliott et al., 2021; Paterson et al., 2023). They are also consistent with the findings of Webb et al.'s (2007) study, which showed that self-generated implementation intentions can increase lecture attendance rates in on-campus lectures. However, the findings of this study provide stronger evidence for the effectiveness of implementation intentions

as a strategy for increasing lecture attendance because an active, rather than passive, control condition was used, meaning that demand effects (e.g., Weber & Cook, 1972) were controlled. In addition, the VHS developed in this study provided a means for university students to develop well-formulated implementation intentions based on evidence-based critical situations and goal-directed responses in a format that ensure adherence to an IF–THEN planning format, which is the critical ingredient that ensures behaviour-change (e.g., Armitage, 2008; Oettingen et al., 2000).

Hypothesis 2 was also supported because the VHS condition maintained its attendance at synchronous online lectures for significantly longer than did the active control condition. The findings therefore extend previous studies of implementation intentions in the context of university lecture attendance (e.g., Webb et al., 2007) and other behaviours (for a review see Gollwitzer & Sheeran, 2006). These studies have measured intervention effectiveness using overall, summative measures of behaviour across a given period (e.g., a week, a month, or longer). They have, therefore, potentially masked the effects of implementation intentions on known variations in behaviour over time (e.g., Skead et al., 2020). On the other hand, the present study showed that encouraging implementation intention formation through the use of a VHS enabled students to maintain their lecture attendance for an additional 2 weeks, on average, and decreased the risk of non-attendance at each time point over the teaching semester by 45%. Furthermore, the magnitude of the behavioural maintenance associated with the VHS increased with time. During the middle of the semester, the participants who received the VHS were between two and three times as likely as the participants in the control condition to have maintained their lecture attendance. By the end of the semester, they were nearly 5 times as likely to have not missed a lecture. The educational benefits that are afforded by sustained lecture attendance (e.g., House et al., 2017; Kim & Seo, 2016) are therefore likely to be increased through the use of the present VHS.

While maintenance was greater in the VHS condition than the active control condition, the proportion of students that maintained a 100% attendance record by the end of the teaching semester was low (14% in the VHS condition versus 3% in the active control condition). An explanation might be that some students in the VHS condition encountered unanticipated critical situations during the teaching semester that put their lecture attendance at risk. Those critical situations might not, therefore, have been specified in their implementation intentions at the start of semester. Thus, when those situations were encountered, a suitable goal-directed response was not initiated. Alternatively, some students may have encountered specified critical situations but the goal-directed responses with which they were linked may have been found to be ineffective. Future research might therefore monitor participants' behaviour after they have completed a VHS (e.g., on a daily or week-by-week basis) and provide opportunities for implementation intentions to be updated when they fail to promote intended action (e.g., lecture attendance).

Hypothesis 3 was not supported because no moderation effect was found between goal intentions and condition in the prediction of the proportion of synchronous online lectures attended or the maintenance of lecture attendance. There was no evidence, therefore, that goal intentions increased the effectiveness of the VHS. While inconsistent with theoretical predictions (e.g., Gollwitzer, 1993) and previous research (e.g., Elliott & Armitage, 2006; Sheeran et al., 2005), it should be noted that the sample means on the measures of goal intentions were close to ceiling ( $M > 8$  for both the VHS and control condition on scale where 9 indicated the strongest possible goal intention to attend lectures). Consistent with previous studies of university student lecture attendance, the lecture attendance was overwhelmingly a goal intended behaviour, meaning that the VHS was a suitable intervention for helping to ensure translation of those goal intentions into actual lecture attendance (cf. Gollwitzer, 1993).

Hypothesis 4 was also not supported. The effects of the VHS on the maintenance of lecture attendance was not moderated by trait conscientiousness. Although the VHS increased the proportion of synchronous online lectures that were attended to a greater extent at high levels of trait conscientiousness, this was counter to expectations and the finding of Webb et al. (2007). Webb et al. (2007) speculated that their findings may indicate that students with low levels of trait conscientiousness experience more

difficulties in overcoming self-regulatory problems that put their lecture attendance at risk compared with students who have high levels of conscientiousness. As a result, they are more likely to benefit from an intervention (e.g., implementation intentions) that helps them overcome these problems. The present findings, however, may suggest that students with high levels of trait conscientiousness will engage more effectively with interventions designed to ensure lecture attendance, such as the current VHS. As a result, implementation intentions might be better encoded to memory for highly conscientious students. Therefore, goal-directed responses that ensure lecture attendance are more likely to be triggered when specified critical situations are encountered (cf. Gollwitzer, 1993). Further research testing the interplay between trait conscientiousness, implementation intention formation and behaviour-change may be warranted.

## Possible limitations

A possible limitation of the present study is that the lectures were delivered online rather than on-campus lecture attendance. The results therefore have direct relevance for online courses, which are becoming more prevalent in higher education (Martin et al., 2020). However, as noted earlier, the lectures were only delivered online as a result of a continued response to the COVID pandemic. The online lectures were synchronous and therefore largely synonymous with on-campus lectures, the students who comprises the sample were registered for an on-campus course, not an online one, and the current VHS covered a comprehensive range of critical situations that put lecture attendance at risk regardless of whether lectures are delivered online or on-campus. Nevertheless, given that synchronous lectures are typically a feature of on-campus courses, future research testing the present intervention using on-campus measures of lecture attendance may be warranted.

Another possible limitation is that the participants in VHS condition were asked to form implementation intentions to help them resist the temptation to miss a lecture by linking critical situations with goal-directed responses, whereas the participants in the active control condition were asked to specify critical situations that would most tempt students (generally) to miss a lecture and, separately, goal-directed responses that students (generally) could use to resist the temptation. The observed increases in synchronous online lecture attendance could therefore have been due to the act of linking critical situations with goal-directed responses or students specifying critical situations and goal-directed responses for themselves specifically rather than students generally. Despite this, the results demonstrate that the VHS improved attendance relative to an extremely stringent control task (cf. Webb et al., 2007). Several studies have also shown that VHSs generate similar improvements in other behaviours relative to control tasks that require participants to specify critical situations and goal-directed responses for themselves specifically (e.g., Armitage, 2008; Armitage et al., 2016).

Finally, the current research was conducted in a single university. Future research might usefully sample from across multiple universities.

## Practical implications

VHSs could be used to help university students' increase and maintain their lecture attendance rates and achieve the associated academic benefits (e.g., Tokumitsu, 2017). The utility of VHSs is that they are brief, cost-effective, and easily administered. Importantly, this intervention may avoid the negative consequences associated with top-down 'required attendance' policies (Lamb et al., 2020). As in this study, a VHS could be administered to university students at the outset of each semester through virtual learning environments or smartphone apps, which are employed at several universities to help students manage their timetables. Smartphone apps would have the added benefit of enabling students to update

and amend their specified implementation intentions, if required (e.g., to cope with new critical situations that might not have been anticipated at the start of semester).

## CONCLUSIONS

This research developed and tested a VHS for increasing university students' attendance at synchronous lectures. The VHS increased the proportion of synchronous online lectures that students attended over the course of a full teaching semester and the maintenance of lecture attendance over that same period. There was also evidence that the intervention may be more effective for students with high levels of trait conscientiousness.

## AUTHOR CONTRIBUTIONS

**Mark A. Elliott:** Conceptualization; investigation; funding acquisition; writing – original draft; writing – review and editing; visualization; validation; methodology; software; formal analysis; resources; data curation; supervision; project administration. **Allan McGroarty:** Conceptualization; investigation; funding acquisition; writing – original draft; writing – review and editing; visualization; validation; methodology; software; formal analysis; project administration; resources; supervision; data curation. **David J. Robertson:** Conceptualization; investigation; funding acquisition; writing – original draft; writing – review and editing; visualization; validation; methodology; software; formal analysis; project administration; resources; supervision; data curation.

## CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## ORCID

Mark A. Elliott  <https://orcid.org/0000-0002-3539-6426>

Allan McGroarty  <https://orcid.org/0000-0003-4217-6947>

David J. Robertson  <https://orcid.org/0000-0002-8393-951X>

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## APPENDIX A

### The list of critical situations in the VHS.

If I am tempted to miss a lecture because I feel demotivated...

If I am tempted to miss a lecture because I feel tired/I'd rather rest...

If I am tempted to miss a lecture because I cannot be bothered...

If I am tempted to miss a lecture because I think the lecture recording/slides are enough on their own to learn the material...

If I am tempted to miss a lecture because I think that attending will not have any benefit beyond watching the lecture recording/looking at the slides...

If I am tempted to miss a lecture because I think the lecture will be boring...

If I am tempted to miss a lecture because I do not think I could face back-to-back lectures (e.g., a lecture for one class followed immediately by a lecture for another; or two lectures for the same class)...

If I am tempted to miss a lecture because I think the lecturer is not very engaging...

If I am tempted to miss a lecture because I have been asked or feel I have to do non-university (paid or voluntary) work...

If I am tempted to miss a lecture because I have a personal (e.g., caring) commitment...

If I am tempted to miss a lecture because I have an appointment (e.g., doctors/dentist)...

If I am tempted to miss a lecture because I am feeling down / low in mood...

If I am tempted to miss a lecture because I have a university deadline approaching (e.g., coursework)...

If I am tempted to miss a lecture because I feel behind/overloaded with university work (e.g., coursework, preparing for tutorials, preparing for exams or doing other tasks for classes)...

If I am tempted to miss a lecture because I am feeling stressed or overwhelmed...

If I am tempted to miss a lecture because I do not think I'll need to learn the content of the lecture for the exam...

If I am tempted to miss a lecture because The weather is miserable (e.g., rain/wind)...

If I am tempted to miss a lecture because I am hungover (or still feeling other effects of the night before)...

If I am tempted to miss a lecture because I think I will have trouble focusing/maintaining concentration...

If I am tempted to miss a lecture because I want to do something more fun (e.g., meet up with friends, go for a coffee)...

## APPENDIX B

### The list of goal-directed responses in the VHS.

...then I will remind myself that attending the lecture should help me to better understand the topic (e.g., provide opportunities to ask questions and hear the answers to questions asked by other students).

...Then I will remind myself that attending lectures should help me get a higher mark.

...Then I will remind myself that I have a responsibility to learn the curriculum.

...Then I will remind myself that all lecture topics can come up in the final exam (i.e., all lectures and associated reading).

...Then I will remember that I need to attend lectures to be a competent, successful student.

...Then I will think about how disappointed I would be in myself for missing the lecture.

...Then I will remind myself that if I try hard enough I can overcome the situation and attend the lecture regardless.

...Then I will remember that I am committed to my studies and have the resources needed to attend and get through the lecture.

...Then I will remember that I have attended lectures in the past so I can do so again this time.

...Then I will make a concerted effort to ignore the temptation.

...Then I will focus on attending the lecture and what I need to do to ensure that happens.

...Then I will try not put myself in that situation again.

...Then I will control the situation to ensure that I do not miss the lecture (e.g., re-arrange appointments/commitments, organize my time better, try to manage my feelings or thoughts).

...Then I will make sure I reward myself if I attend the lecture.

...Then I will attend the lecture anyway but do something nice for myself afterwards.

...Then I will remember that there are support services in the university that can help me with things that might prevent me from attending lectures (e.g., Student Support & Wellbeing Service; Student Union; Study Skills).

...Then I will seek help from someone who can help me manage this situation (e.g., tutor, friends, family, doctor).

...Then I will think about the negative feelings I would experience if I missed the lecture (e.g., guilt, additional stress/feelings of unease from falling behind with the class, fear of failure).

...Then I will think how much better I would feel for attending the lecture (e.g., reassurance from keeping up with the class, feeling more likely to succeed).

...Then I will remember that it creates a poor learning environment when lectures are not well attended.

...Then I will tell myself that I will be contributing to a better learning environment for everyone if I attend the lecture (e.g., being available for discussions/responding to questions that demonstrate important concepts or ideas).

...Then I will remind myself that my absence might be noticed/will be recorded.

...Then I will remind myself that there is a societal expectation for me to attend lectures.

...Then I will remind myself that society is not accepting/critical of students who miss lectures.