Persuasive and Affective SMS text messaging for Students' Learning

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May 2011

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Executive Summary

This report presents the outcome of an experimental design to investigate the impact of persuasive and affective SMS on students' self-regulated learning strategies while attending an introductory information systems course over a 12 week trimester. The participants were undergraduate students enrolled in INFO 101 at a tertiary institution in New Zealand. The instrument used in this study was based on the motivated strategies for learning questionnaires (MSLQ) developed by Pintrich (1995). MSLQ measures three general types of strategies: cognitive, meta-cognitive and resource management. The findings of the research identified that several aspects of students' learning strategies such as Control of Learning Beliefs (CLB), Task Value (TV), Extrinsic Goal Orientation (EGO), Self-Efficacy for Learning and Performance (SELP), Meta-cognitive Self-Regulation (MSR), Organisation (OR), Elaboration (EL), Time and Study Environment Management (TSEM), and Rehearsal (RH) had been improved for the experiment group while the Time and Study Environment Management (TSEM) dimension of MSLQ had been significantly lowered for the control group who received no SMS intervention. The study demonstrates a positive impact of persuasive and affective SMS on students' learning and suggests that the intervention is able to provide stabilising and stimulating effects on students' self-regulated learning compared to the control group. Moreover the study shows that students who received SMS intervention performed better than students who did not receive SMS intervention. Most importantly, the study shows that SMS intervention enables Maori and Pacific students, who historically have a lower performance than the main cohort, to perform better than the main cohort and to a significantly higher level than those Maori and Pacific students who did not receive any SMS intervention. This study demonstrates the effectiveness of a simple SMS intervention system. This study suggests that practitioners should consider the adoption of the persuasive and affective SMS strategy. They should adopt the seven principles of persuasive technology for sending SMS messages. They should also target the persuasive and affective SMS strategy to high risk students and they should conduct pre- and post-intervention surveys to provide insight to students' learning strategies.

1. Introduction

Higher education can be an expensive investment for some stakeholders. It was reported (TEC, 2010) that in 2009, the course completion rate at levels 5-6 (Diplomas and Graduate Certificates) was 74% and the course completion rate at levels 7-8 (Degrees, Postgraduate Diplomas and Honours) was 84% in New Zealand's universities. Given the total number of equivalent full-time students reported in 2009 was 118,918 in New Zealand tertiary institutions and assuming a conservative cost of $500 per course, the amount of lost "investment" can be very substantial. Apparently, local universities are taking steps to minimise such a problem in order to compete with universities worldwide for high quality international students as well as for government funding. Various student support services currently provide learning support such as peer tutoring, learning strategies workshops, and examination preparation in order to motivate and encourage students' cognitive and non-cognitive learning. Some of these student learning support services are specifically targeted toward Maori and Pacific students. For example the Manaaki Pihipihinga programme focused on academic achievement within the cultural framework of cooperative learning through the provision of one-to-one mentoring support (VUW, 2011a). Other frequently used screening strategies identify high risk learners at the beginning of a semester and provide them with additional enrichment programmes. One such strategy which could differentiate between high and low achieving students is to look at their capacity to use self-regulated strategies (Pintrich & DeGroot, 1990; Watson et al., 2004). This strategy is reliable as it has been extensively researched and is grounded in learning theory. Self-regulation refers to self-regulated thoughts, feelings and behaviour that are oriented to attaining goals (Zimmerman, 2002). Various studies have consistently confirmed a significant correlation between academic performance and self-regulated learning (Pintrich & DeGroot, 1990; Pintrich et al., 1993; Watson et al., 2004; Chang, 2005). A study by Bergin, Reilly, and Traynor (2005) examining the role of self-regulated learning on performance on an introductory programming course revealed that students who performed well in programming used more meta-cognitive and resource management strategies than weaker students. A study by Kosnin (2007) on academic achievement measured by the students' grade point average showed that resource management strategies, test anxiety, meta-cognitive learning strategies and self-efficacy were significant predictors of learning achievement. Among the high achievers those who have more control of learning beliefs and use more resource management strategies achieve better while among the low achievers those who use more meta-cognitive learning strategies, and

have higher test anxiety and low internal attribution of control over learning as well as low task value achieve better (Kosnin, 2007, p.225).

Hence measuring students' self-regulated learning capacity can be a good predictor for academic performance and can be used to measure the effectiveness of intervention strategies deployed during students' learning processes.

2. Background

2.1 Student Support and Intervention Programmes

Intervention strategies such as developmental programmes are commonly introduced during student orientation. The disadvantages of this type of intervention programme are its limited impact and duration. After the orientation, students tend to forget about the skills learned. Programme such as the Āwhina, Manaaki Pihipihinga and the Tuākana (VUW, 2011b; University of Auckland, 2011) offer mentoring support to Maori and Pacific students. These kinds of interventions are commonly found in New Zealand's universities. These programmes have demonstrated their usefulness in creating a more culturally sensitive environment but may require considerable resources. Massey University piloted an extramural student peer mentoring project in 2008 in response to a high rate of failure and non completion among the first year students (Pukepuke & Nash, 2009). Overall the peer mentoring interventions are reported to have positive outcomes in terms of achievement and retention. However, it was found that such schemes are not only time consuming and resource intensive but require clear goals and a plan of interventions customised for the needs of students. The "Success for all" intervention programmes developed by the University of Auckland intend to improve Maori and Pacific students' success in degree-level studies (Airini et al., 2008). The focus is on non-lecture teaching activities that are useful for Maori and Pacific students. No quantitative data have been provided on achievement or retention so far. Recently a pilot intervention programme at Victoria University looked at ways to proactively identify academically at risk students, collaboratively define the support they require, and assist them to develop strategies to achieve a better passing grade (Chong, 2011). It was reported that the outcome of the intervention was rather disappointing even though the targeted at risk students (core BCA 'E' graders) were encouraged by their tutors to set realistic goals. Further, Maori, Pacific and Asian students were found to be overly represented in the at risk group. It is clear that these interventions and support systems are too

resource intensive. Perhaps other more economical and sustainable strategies such as persuasive and motivational SMS reminder messages (Wickramanayake & Schlosser, 2006; Maheshwari et al., 2008; Trappey & Woodside, 2005) which have been found to be useful in health, advertising and education should be explored.

2.2 Persuasive and Affective SMS Intervention System

The SMS intervention system consists of a mobile phone connected to a laptop computer through a USB cable. MyPhone explorer software was used to send and receive SMS text messages. The software allows students to be grouped according to their timetable. This allows the instructor to customise the SMS messages for different categories of students and to organise messages according to the persuasive technology principles.

Persuasive technology is the adoption of computing technology in an attempt to change attitudes and behaviour (Fogg, 2003). This technology is not limited to the health care industry or social organisations which frequently use it in their preventive and social marketing campaigns (Prentice-Dunn et al., 2001). In the education sector for example, Revelle et al. (2007) used mobile phones to deliver educational materials to improve literacy among pre-school children. The project focused on sending motivating SMS and audio messages with Sesame Street characters to parents so as to assist their children with learning the alphabet. Their study demonstrated that using mobile technology to motivate parents and children to boost literacy levels is an effective way to assist learning.

For the present study, the messages sent to students were constructed using the concept of persuasive principles as suggested by Fogg (2003). Fogg identified various persuasive principles that can be used to effect behaviour change. These practical principles were adopted in this study.

The *principle of simplification* focuses on reducing a complex task to a simpler task by removing steps in the process. In this study we used txt terminology and the English language to communicate important notices like assignment due dates to students. Txt terminology is easier for students to read, comprehend and respond to. In addition, these messages reduce the need for students to login to their Blackboard account and navigate through various notices and folders in order to retrieve the right information. This is because SMS messages are stored in their mobile phone which is readily available, thus making complex information retrieval tasks simple. Fogg (2003) asserts that this principle makes an action easier to perform and increases the benefit of the behaviour.

The *principle of tailoring or personalisation* looks at using relevant personalised information as part of the intervention message to individuals for modifying behaviour and attitudes. The SMS sent to students were tailored to students. The messages reminded them about the specific times and rooms for tutorials, lectures and workshop sessions. The SMS were also tailored to influence Maori students using proverbs in te Reo and motivational messages in English and a mix of the two was used for other participants.

The concept of *persuasion through personalisation* creates the perception that information has been tailored to suit them. It can be applied to motivational messages that are time and situation sensitive to encourage students to turn in their assignment a few hours before the due date. When individuals think that messages have been personalised for them, they tend to pay more attention. Fogg (2003) asserts that timing is essential in order for persuasive technologies to be effective.

The *principle of suggestion* proposes that interventions should be performed at the most opportune moments, i.e. when people have the ability and motivation to respond (Ferebee, 2010). In other words, people are more inclined to be persuaded if a suggestion is made at the right time. In this study, sending a persuasive SMS reminder to review a chapter or a case study in the morning before a student's tutorial is more likely to encourage the student to review the material than if the reminder was sent only to remind him/her to attend the tutorial.

The *principle of conditioning* uses praise or positive reinforcement to change or influence behaviour. In this study this principle was followed by sending out simple encouraging messages like "ka pai / good work! You have reached week five of the term". This encouraged the students to go on with the course as they felt that they received personal praise for continued attendance. Fogg (2003) asserts that the gentler the intervention used to obtain the desired behaviour, the better the outcome in the long term.

The *principle of tunnelling* is the use of a sequence of tasks, one at a time, to ensure completion. This means guiding users through a series of actions, giving opportunities to achieve goals along the way. This principle is used in constructing periodic SMS messages for students to encourage them to adequately prepare for their assignments and hand them in on time. Sample messages are depicted in Appendix 2.

2.3 Motivated Strategies for Learning Questionnaires

MSLQ has been used extensively to measure the impact on students' beliefs in different teaching environments and contexts. Chang's (2005) study on self-regulated learning

strategies in web-based instruction revealed that students became more responsible for their own learning, more intrinsic goal-oriented and more challengeable. They tended to value the learning content more and became more confident in content understanding and class performance. In a study of foreign language learning, Huang (2008) suggested that there is little difference between second language learning and other subjects in the school environment and the MSLQ is capable of measuring second language related studies. In a study by Sungur and Tekkaya (2006) on the use of problem based learning (PBL) strategies, students showed higher levels of intrinsic goal orientation, task value, use of elaboration learning strategies, critical thinking, meta-cognitive self-regulation, effort regulation, and peer learning compared with normal non-PBL students. Recently Arsal (2010) studied the effect of diaries on the self-regulation strategies of pre-service science teachers, showing that the intrinsic motivation, task value, meta-cognition, self-efficacy, elaboration, effort regulation and time management strategies of the experimental group were significantly higher than those of the control group. These recent examples clearly support the use of MSLQ as an instrument for measuring impact on students' learning strategies as it can be applied to different learning situations such as the current SMS intervention strategy.

3. The Study

The purpose of this study is to identify the effectiveness and impact of a persuasive SMS intervention strategy on students' self-regulated learning in an information systems course. Specifically, this study investigates the following three questions:

1. What are the impacts on students' self-regulated learning strategies without an SMS intervention?

2. What are the impacts on students' self-regulated learning strategies when an SMS intervention is introduced?

3. What are the impacts on Maori and Pacific students' self-regulated learning strategies when an SMS intervention is introduced?

The participants in the study were recruited from an introductory course. The course used in the study is INFO 101. The course has three modules and each module is taught by a different instructor. The course assessment requirements include six tutorial submissions, completion of eight workshops, tutorial participation, a web assignment and a web design test, a database assignment and a database design test. In the final examination students are required to attain a mark of at least 40%. Participation in the study was voluntary and after the pre-survey the

participants were separated into a control group and an experiment group. Because the Maori and Pacific students' samples were small, it was decided to place them all into the experiment group in order to maintain an acceptable effect size. Only the experiment group received SMS reminder texts with persuasive and encouraging phrases twice a week. The SMS reminders mainly encouraged students to attend lectures, tutorials and workshops and to complete assignments. The experiment was conducted for nine weeks, from week 3 to week 11. A pre-survey was conducted at the beginning of the experiment and a post-survey was conducted in week 12. Both surveys used MSLQ as the measuring instrument. MSLQ consists of motivation and learning strategy components (Duncan and McKeachie, 2005). The motivation components comprise 31 items measuring students' goals for and value beliefs about a course and their beliefs about their ability to succeed in a course. The learning strategy components also consist of 31 items measuring students' use of different cognitive and meta-cognitive strategies, and 19 items measuring student management of resources. In total MSLQ consists of 81 items. These items are scored on a 7-point Likert scale from 1 (not at all true of me) to 7 (very true of me). MSLQ can be organised into 15 sub-scales. The motivation scales are Intrinsic Goal Orientation (IGO), Extrinsic Goal Orientation (EGO), Task Value (TV), Control of Learning Beliefs (CLB), Self-Efficacy for Learning and Performance (SELP), and Test Anxiety (TA). The learning strategies scales are Rehearsal (RH), Elaboration (EL), Organisation (OR), Critical Thinking (CT), Meta-cognitive Self-Regulation (MSR), Time and Study Environment Management (TSEM), Effort Regulation (ER), Peer Learning (PL) and Help Seeking (HS).

4. Findings and Discussion

4.1 Demographics

A total of 92 students participated in the study but only 57 students managed to complete both the pre-survey and post-survey. Both the pre-survey and post-survey used the MSLQ instrument. The demographic distribution of the participants is shown in Table 1 (all tables are in Appendix 1). There are almost equal numbers of male and female students in the experiment group. The control group is 76% female and 24% male while the experimental group is 56.2% male and 43.7% female. The majority of the students were first year and second year students aged between 16 and 25 years old. These are mainly students who have just graduated from high school and have limited university learning experience.

4.2 MSLQ Impact Evaluation

4.2.1 Control Group

In this research we asked the question: *what are the impacts on students' self-regulated learning of attending a first year information system course over a trimester of 12 weeks? A* series of t-tests and a General Linear Modelling analysis of covariance method adjusted for the pre-survey score were performed to evaluate any significant difference in self-regulated learning components between the control and experiment groups. We determined that 7 out of 81 items were significant ($P < 0.1$) or tended toward significant differences initially as shown in Table 2. The mean scores indicate that the experiment group has a slightly higher score in these items. These items are from the sub-scales of SELP, TV, MSR, OG and RH. When compared within the control group, the results reveal that five items and one sub-scale in resource management are significantly ($P < 0.1$) different or tend toward significant difference. Table 3 shows the t-test on the control group between the pre and post course experience. Two items from the critical thinking (CT) sub-scale improved, implying this course stimulated some critical thinking. However one item each from ER and MSR were lower and the sub-scale TSEM was significantly lower. One would expect that without intervention strategies, the majority of the first year students will find it challenging to manage their time and effort in learning. During the learning process, first year students can easily "lose" control over their management of time. Previous research has indicated that TSEM is an important factor that high achievers possess; hence deficiency in such an important scale means the control group is likely to underperform.

4.2.2 Experiment Group

In the education sector, SMS technology has been deployed to provide "mobile scaffolding" to support and guide students towards independent self-management (Stone, 2004). Generally SMS support has been found to be useful for students. However, most researchers have not identified how SMS support influences self-regulated learning. Hence in this research we are particularly interested in investigating the question: *what are the impacts on students' self-regulated learning in a first year information systems course over a trimester of 12 weeks when a SMS intervention is introduced?* By introducing a persuasive and affective SMS reminder service, we compared the responses to MSLQ. Table 4 shows the t-test on the experiment group between the pre and post course experiences. Interestingly,

Table 4 indicates that only seven items from the experiment group were significant (P<0.1) or tended toward significant difference. These items are from the EGO, ER, CT, MSR and TSEM sub-scales. The resource management scale of peer learning had a significant impact on the experiment group. At this stage one would think that the SMS reminder service has had a limited impact on students' self-regulated learning. Surprisingly when compared with the control group post MSLQ, thirteen items and three sub-scales of TV, EL and TSEM were significant (P<0.1) or tended toward significant difference. TSEM had been lowered in the control group but not in the experiment group as shown in Table 5. Thus the intervention introduced to the experiment group has caused a "stabilising" effect on the group's TSEM. This finding is similar to that of Arsal (2010) where the use of diaries improved time management for the experiment group but not the control group. From Table 5, the SMS intervention caused a series of "chain" reactions on various sub-scales; the impacts were small enough to show no significant difference within the experiment group but large enough when compared with the control group in which items had also been lowered slightly.

4.2.3 Maori and Pacific Group

The impact of the intervention on Maori and Pacific students was examined. In particular we investigated: *what are the impacts on Maori and Pacific students' self-regulated learning of attending a first year information systems course over a trimester of 12 weeks when a SMS intervention is introduced?* Five items on the Expectancy scale, two items on the Cognitive strategies scale and one item each on the Meta-cognitive and Resource management scales were significantly (P<0.1) different from the control group initially as shown in Table 6. The higher expectancy scores suggest that Maori and Pacific students perceived themselves to have considerable ability and confidence in the skills they need in order to accomplish tasks compared to the control group and they seem to organise their thoughts better and were more able to stick to a study schedule. They have high expectations for themselves. In general most other components such as value, affect, cognitive strategies, meta-cognitive strategies and resource management are similar to those of the control group.

After one trimester of learning and periodic interventions through SMS, the experiment group showed some impact on their self-regulated learning strategies as shown in Table 7. Notably one item each from Task Value (TV), Peer Learning (PL), Elaboration (EL), Rehearsal (RH), and Critical Thinking (CT) have improved while Time and Study Environment (TSEM) which relates to class attendance has suffered over the trimester which

is typical in this course. However, Peer Learning appears to have improved over the trimester. Over the trimester the experiment group has improved on their scores in Cognitive strategies. They also appreciate the value of the course more. It is likely that there were more effects on the self-regulated learning strategies due to the interventions but they may not have been strong enough to show significant difference within the experiment sub-group.

However when compared to the control group, the post intervention learning experience of the experiment sub-group showed stronger and substantial improvement in Value, Expectancy, Cognitive strategies, Resource management and Meta-cognitive strategies as shown in Table 8. Fourteen items within these scales have higher scores than those of the control group. It is more likely that the periodic interventions have developed a positive time management mind-set in the learners and a greater desire for value and expectancy components and these in turn increased their needs for cognitive and meta-cognitive strategies in order to fulfil their value components. Without the intervention, the control group may have made slight changes in some of these components but it was not substantial enough to show significant differences within the control group.

For the Maori and Pacific students sub-group, the use of cognitive strategies such as RH and EL was more prevalent. The use of effective resource management such as peer learning and help seeking was rather limited and not significant while the use of value components was greater. Similar findings were also reported by Arsal (2010).

4.3 Learning Achievement Evaluation

4.3.1 SMS and Non SMS Group

To compare grade performance, letter grades were translated to numerical values using the mid-point value for each letter grade. The range between two mid-points is five points. We compared students who received SMS intervention and students who did not receive SMS intervention for the entire cohort. The cohort consists of 1199 students in which 142 are Maori and Pacific students. T-test analysis shows that the students who received SMS intervention out-performed those students who did not received SMS. The difference is significant at the 0.05 level (t(33.938)=2.657 P=0.012; Mean SMS=70.66, SD=16.628; Mean Non-SMS=62.67, SD=21.617)). For the control group *Cognitive strategies* and *Resource management* were highly correlated to the final course grade as shown in Table 9. Resource management is mainly due to *Peer learning* and *Help seeking* while the use of cognitive

strategy is mainly due to *Elaboration*. For the experiment group, we were not able to identify components significantly correlated with final grade performance.

4.3.2 Maori and Pacific Students' Group

Historically, Maori and Pacific students have not performed as well as the main cohort in INFO 101. We compared the mean final grade score of Maori and Pacific students (non SMS group) and the remaining cohort (non SMS and non Maori and Pacific students). The mean final grade score for Maori and Pacific students is significantly lower than the main cohort (t(1165)=-3.764, P=0.000; Cohort Mean=63.48, SD=21.623; Maori and Pacific Mean=55.80, SD=20.39). However, when we compare the Maori and Pacific students who received SMS intervention with the cohort of students who received no intervention, the mean final grade scores for the Maori and Pacific students were higher than the remaining cohort (non SMS) and significant at the 0.05 level (t(19.042)=2.288, P=0.034; Cohort Mean=62.67, SD=21.617; Maori and Pacific Mean=68.83, SD=11.11). This shows an improvement. Thus the interventions strengthened various aspects of the self-regulated learning strategies of the Maori and Pacific students and elevated their grade performance to a level higher than the main cohort. We further compared Maori and Pacific students who received SMS with Maori and Pacific students who did not receive SMS intervention. The result showed that Maori and Pacific students who received SMS intervention achieved significantly higher scores than Maori and Pacific students who did not receive SMS intervention (t(36.482)=4.079 P=0.000; SMS Mean=68.83, SD=11.11; Non SMS Mean=55.80, SD=20.39). While the impact of the intervention has been shown to be positive and desirable, it is the change of attitude and regulated learning strategies that are most important.

For the experiment sub-group, we were not able to identify components significantly correlated with final grade performance. It is also possible that the experiment group contains different student profiles utilising multiple strategies to attain good performance (Kosnin, 2007).

4.4 Focus Group Evaluation

In addition to quantitative analysis, we conducted three focus group interviews to elicit opinions from the participants. Six students – four females and two males – participated. The participants were from the experimental group as we were particularly interested in their experience with the SMS intervention. Each interview lasted about 12 minutes. During the

focus group interviews, all students said they liked receiving SMS messages; they particularly liked receiving reminders about assignment submission dates and lecture materials. Students' motivation levels were high due to the inspiring nature of some of the persuasive and affective messages. High motivation is likely to positively influence the value dimension in the MSLQ. The participants also felt more inclined to attend classes and submit assignments on time due to the attention they received in this class from the messages sent. One student mentioned that she felt that she had to have a good lecture attendance record as she felt she was getting personal attention through the SMS messages. Students also indicated that they were better organised in this course as the reminders helped them to structure their time better as the messages gave a countdown to when assignments were due. This was also positively reflected in the resource management dimension in MSLQ.

However, some students felt that some of the SMS messages had too much information in them and felt overloaded by this information. One student suggested sending more messages with less information throughout the week, while another suggested constructing messages around the lecture material and the study questions. Overall the interviewed students appreciated the reminders sent and felt encouraged by the motivational messages. A sample of students' responses and their potential relation to MSLQ components is depicted in Appendix 3.

4.5   Reflection on Research

The persuasive SMS messages are a viable and effective strategy for maintaining, improving and enhancing students' self-regulation strategies. Moreover, practitioners can complement this strategy with other motivational strategies to enhance students' learning experiences, especially for first year courses and students. The SMS strategy is not only easy to implement, it is also very responsive. It can provide a more immediate response than email. Moreover, mobile phone SMS messaging is already a widely adopted communication channel for students. As the research has demonstrated, MSLQ is rather dynamic in nature. The dynamic nature of the items within MSLQ could possibly explain various inconsistencies, negative correlations or poor explanation power when correlated with academic performance (Kosnin, 2007; Chen, 2002). Therefore we suggest that practitioners who intend to implement an intervention system using MSLQ should perform multiple surveys at different time intervals to obtain more reliable data and derive methods to determine factors that can predict academic performance more consistently.

One of the main difficulties we faced during the course of the experiment was to get sufficient participation from Maori and Pacific students. This has limited our sample size which will otherwise allow stronger generalisation. It seems that Maori and Pacific students were less enthusiastic in seeking assistance from support such as the SMS intervention. A similar observation was made by Chong (2011) in his report, which revealed that although learning support for Maori and Pacific students is available and well-advertised, at risk Maori and Pacific students frequently cited "not knowing where to get help" as the main reason for their failure. One option we will consider in future is to make participation in the MSLQ survey a course requirement as voluntary participation may bias towards students who are already motivated toward learning. We tend to believe the SMS intervention is most suitable for first year university students who have just graduated from high school because their time management and self regulated learning skills may not be as mature as those of the senior students.

The experiment has demonstrated the positive impact of SMS intervention on self regulated learning strategies and achievement. It would be better if we were able to identify which dimensions of self regulated learning strategies actually influence achievement. This would allow more specific interventions to be used in a more efficient way. Unfortunately we were not able to identify those specific dimensions due to low significant values of the correlation coefficients. Another difficulty in the experiment was that we were not able to eliminate other influencing factors such as the number of courses each participant took during the experiment. This factor is important as it directly influences the resource management of each individual and potentially affects overall achievement.

5. Conclusions and Recommendations

This study has demonstrated the usefulness and effectiveness of a simple SMS strategy in engaging and stimulating students' self-regulated learning. Improvement in self-regulated learning is shown to be positively correlated to higher academic performance. This research explores the use of SMS technology as a persuasive and affective tool to improve engagement and participation amongst undergraduate students at Victoria University. This study uses Fogg's persuasive principles as an underpinning conceptual framework. The study demonstrated the capability of an SMS intervention for stimulating students' self-regulated learning through better time management and improved extrinsic and intrinsic goals, cognitive and meta-cognitive strategies and values. The impacts on students' academic

achievement were very encouraging with improvement in final course grades for students who received SMS intervention. Unlike other intervention programmes targeted at Maori and Pacific students, we used a validated and theory grounded instrument to measure the learning strategies' outcomes. Unlike other intervention programmes, the SMS intervention is able to demonstrate the dynamic nature of students' learning strategies and motivation reflected by MSLQ responses and the potential strategies for modifying students' self- regulated learning capacity.

We recommend a few areas for practitioners to consider when implementing such a system. First, practitioners should consider the impact on other courses when SMS intervention is applied to a specific course to ascertain that the benefits gained from one course did not compromise other courses. Likewise practitioners should ascertain whether such interventions are more effective for students with a specific learning problem. Next, with the increasing use of social media such as Facebook and Twitter, practitioners should consider using these tools as a form of intervention similar to SMS intervention and apply the MSLQ to measure the impact. Lastly, from a culturally responsive perspective, practitioners can enlist parents to send SMS messages. This is more likely to influence the affective and emotional state of the students as well as harnessing the affective communication between students and family.

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Appendix 1

Table 1 Participant Demographics

	Control	%	Experiment	%
Male	6	24.0	18	56.2
Female	19	76.0	14	43.7
Total	25	100	32	100
Age				
16-20	20	80.0	22	68.7
21-25	5	20.0	9	28.1
>40	0	0.0	1	3.1
University				
1st year	15	60.0	24	75
2nd year	7	28.0	7	21.8
3rd year	1	4.0	1	3.1
4th year	2	8.0	0	0.0
Ethnicity				
1: Maori	0	0.0	11	34.3
2: New Zealand/Pakeha	23	92.0	9	28.1
3: Pacific islanders	0	0.0	5	15.6
4:Asian	2	8.0	5	15.6
5:Indian	0	0.0	2	6.2

Table 2 Comparing the control and experiment groups' pre course experience on MSLQ

				Pre control N=25		Pre experiment N=32		
QID	Items	Sub -Scale	Scale	M	SD	M	SD	SIG
28	I'm confident I can do an excellent job on the assignments and tests in this course.	SELP	Expectancy	4.76	1.012	5.31	1.281	0.083
29	I expect to do well in this class.	SELP	Expectancy	4.96	1.098	5.66	1.096	0.021
34	I like the subject matter of this course.	TV	Value	4.35	1.536	5.16	1.609	0.066
39	Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.	SELP	Expectancy	4.75	1.032	5.31	1.061	0.052
40	When I study the readings for this course, I outline the material to help me organize my thoughts.	OR	Cognitive strategies	4.13	1.424	5.03	1.596	0.032
49	When I become confused about something I'm reading for this class, I go back and try to figure it out.	MSR	Meta-cognitive	5.00	1.414	5.70	1.055	0.042
67	I memorize key words to remind me of important concepts in this class.	RH	Cognitive strategies	4.67	1.308	5.28	1.326	0.090

Table 3 Comparing control group pre and post course experience on MSLQ

				Pre control N=25		Post control N=25		
QID	Items	Sub-Scale	Scale	M	SD	M	SD	SIG
45	I often feel so lazy or bored when I study for this class that I quit before I finish what I planned to do.	ER	Resource management	3.75	1.260	4.56	1.417	0.040
46	I often find myself questioning things I hear or read in this course to decide if I find them convincing.	CT	Cognitive strategies	3.64	1.677	4.40	1.354	0.091
74	I try to play around with ideas of my own related to what I am learning in this course.	CT	Cognitive strategies	3.87	1.359	4.52	1.262	0.092
81	I attend this class regularly.	TSEM	Resource management	6.71	0.550	5.28	1.696	0.000
87	If I get confused taking notes in class, I make sure I sort it out afterwards.	MSR	Meta-cognitive	5.09	1.411	4.24	1.535	0.053
	Aggregate impact on sub-scale:	TSEM	Resource management	4.84	0.875	4.30	0.759	0.025

Table 4 Comparing experiment group pre and post course experience on MSLQ

QID	Items	Sub-Scale	Scale	Pre experiment N=32		Post experiment N=32		
				M	SD	M	SD	SIG
17	It is my own fault if I don't learn the material in this course.	EGO	Value	6.09	1.058	5.50	1.545	0.078
41	During class time I often miss important points because I'm thinking of other things.	MSR	Meta-cognitive	4.16	1.568	4.94	1.544	0.049
45	I often feel so lazy or bored when I study for this class that I quit before I finish what I planned to do.	ER	Resource management	3.41	1.794	4.16	1.743	0.095
68	When course work is difficult, I either give up or only study the easy parts.	ER	Resource management	2.84	1.483	3.94	1.966	0.015
74	I try to play around with ideas of my own related to what I am learning in this course.	CT	Cognitive strategies	4.22	1.791	4.94	1.390	0.078
81	I attend this class regularly.	TSEM	Resource management	6.75	0.672	6.06	1.722	0.039
87	If I get confused taking notes in class, I make sure I sort it out afterwards.	MSR	Meta-cognitive	4.97	1.602	4.25	1.566	0.077
	Aggregate impact on sub-scale:	PL	Resource management	3.50	1.261	4.07	1.372	0.087

Table 5 Comparing the control and experiment groups' post course experience on MSLQ

QID	Items	Sub-Scale	Scale	Post control N=25		Post experiment N=32		
				M	SD	M	SD	SIG
12	I think I will be able to use what I learn in this course in other courses.	TV	Value	4.56	1.530	5.71	1.189	0.003
15	Getting a good grade in this class is the most satisfying thing for me right now.	EGO	Value	4.72	1.768	5.87	1.258	0.010
23	I'm confident I can understand the most complex material presented by the instructor in this course.	SELP	Expectancy	4.42	1.666	4.91	1.146	0.070
30	The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.	IGO	Value	4.60	1.633	5.22	1.157	0.074
31	I think the course material in this class is useful for me to learn.	TV	Value	4.92	1.640	5.53	1.107	0.072
35	Understanding the subject matter of this course is very important to me.	TV	Value	4.52	1.851	5.38	1.100	0.094
38	I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.	EGO	Value	5.38	1.096	5.91	1.228	0.100
68	When course work is difficult, I either give up or only study the easy parts.	ER	Resource management	3.17	1.465	3.94	1.966	0.013
73	I have a regular place set aside for studying.			4.54	1.560	5.31	1.674	0.034
80	I make lists of important items for this course and memorize the lists.	RH	Cognitive strategies	3.64	1.469	4.47	1.685	0.100
81	I attend this class regularly.	TSEM	Resource management	5.28	1.696	6.06	1.722	0.101
86	When I study for this class, I set goals for myself in order to direct my activities in each study period.	MSR	Meta-cognitive	3.96	1.645	4.91	1.510	0.037
89	I try to apply ideas from course readings in other class activities such as lecture and discussion.	EL	Cognitive strategies	4.61	1.406	5.16	1.293	0.070
	Aggregate impact on sub-scale:	TV	Value	4.67	1.373	5.43	0.923	0.020
		EL	Cognitive strategies	4.92	0.684	5.31	0.838	0.069
		TSEM	Resource management	4.30	0.759	4.69	0.950	0.063

Table 6 control group and experiment groups' MSLQ items' correlate with performance

	Scale	Correlation	Significant
Control	Cognitive Strategies EL	0.389	0.067
	Resource Management PL HS	0.551	0.006
Experiment	none		
Maori and Pacific	none		

Table 7 Comparing control and experiment sub-groups' pre-course experience on MSLQ

				Pre control N=25		Pre experiment N=16		
QID	Items	Sub-Scale	Scale	M	SD	M	SD	SIG
26	If I try hard enough then I will understand the course material.	CLB	Expectancy	5.87	0.757	6.44	0.814	0.032
28	I'm confident I can do an excellent job on the assignments and tests in this course.	SELP	Expectancy	4.76	1.012	5.56	1.031	0.018
29	I expect to do well in this class.	SELP	Expectancy	4.96	1.098	6.00	1.033	0.004
37	I'm certain I can master the skills being taught in this class.	SELP	Expectancy	4.92	1.100	5.81	0.981	0.012
39	Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.	SELP	Expectancy	4.75	1.032	5.44	1.094	0.051
40	When I study the readings for this course, I outline the material to help me organize my thoughts.	OR	Cognitive strategies	4.13	1.424	5.13	1.500	0.040
49	When I become confused about something I'm reading for this class, I go back and try to figure it out.	MSR	Meta-cognitive	5.00	1.414	5.98	0.998	0.027
60	I find it hard to stick to a study schedule.	TSEM	Resource management	5.00	1.694	4.00	1.751	0.079
	Aggregate impact on sub-scale:	SELP	Expectancy	4.82	0.896	5.50	0.867	0.022
		OR	Cognitive strategies	4.60	0.783	5.09	0.948	0.083

Table 8 Comparing experiment sub-group pre and post course experience on MSLQ

				Pre experiment N=16		Post experiment N=16		
QID	Items	Sub-Scale	Scale	M	SD	M	SD	SIG
18	It is important for me to learn the course material in this class.	TV	Value	5.69	1.138	6.31	0.602	0.062
42	When studying for this course, I often try to explain the material to a classmate or a friend.	PL	Resource Management	3.69	1.580	4.75	1.693	0.076
72	When reading for this class, I try to relate the material to what I already know.	EL	Cognitive Strategies	5.13	1.544	6.00	0.966	0.064
74	I try to play around with ideas of my own related to what I am learning in this course.	CT	Cognitive Strategies	3.94	1.692	5.19	1.424	0.031
80	I make lists of important items for this course and memorize the lists.	RH	Cognitive Strategies	3.75	1.000	4.88	1.628	0.025
81	I attend this class regularly.	TSEM	Resource Management	6.56	0.892	5.44	2.159	0.064

Table 9 Comparing control and experiment sub-groups' post course experience on MSLQ

QID	Items	Sub-Scale	Scale	Post control N=25		Post (sub-group) experiment N=16		
				M	SD	M	SD	SIG
10	If I study in appropriate ways, then I will be able to learn the material in this course.	CLB	Expectancy	6.08	0.759	6.63	0.619	0.023
12	I think I will be able to use what I learn in this course in other courses.	TV	Value	4.56	1.530	5.69	1.138	0.010
15	Getting a good grade in this class is the most satisfying thing for me right now.	EGO	Value	4.72	1.768	5.69	1.493	0.073
18	It is important for me to learn the course material in this class.	TV	Value	5.76	1.451	6.31	0.602	0.045
23	I'm confident I can understand the most complex material presented by the instructor in this course.	SELP	Expectancy	4.40	1.633	5.31	0.946	0.042
26	If I try hard enough then I will understand the course material.	CLB	Expectancy	5.72	0.792	6.50	0.632	0.005
52	If course readings are difficult to understand, I change the way I read the material.	MSR	Meta-Cognitive	4.25	1.391	5.00	1.414	0.108
57	I make simple charts, diagrams, or tables to help me organize course material.	OR	Cognitive	3.76	1.855	4.81	1.834	0.044
61	When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions.	EL	Cognitive	5.24	1.268	5.94	0.929	0.102
72	When reading for this class, I try to relate the material to what I already know.	EL	Cognitive	5.32	1.069	6.00	0.966	0.072
73	I have a regular place set aside for studying.	TSEM	Resource management	4.60	1.555	5.56	1.672	0.036
80	I make lists of important items for this course and memorize the lists.	RH	Cognitive	3.64	1.469	4.88	1.628	0.015
86	When I study for this class, I set goals for myself in order to direct my activities in each study period.	MSR	Meta-cognitive	3.96	1.645	5.19	1.377	0.020
89	I try to apply ideas from course readings in other class activities such as lecture and discussion.	EL	Cognitive	4.61	1.406	5.27	1.280	0.097
Aggregate Impact on Sub Scale:		TV	Value	4.67	1.373	5.45	0.891	0.018
		RH	Cognitive	4.29	0.809	5.03	1.247	0.042
		EL	Cognitive	4.92	0.684	5.40	0.774	0.049

Appendix 2

Text: kia ora, this is going 2 b a tough wk bt u can make it there! Begin ur 101 Access assignment do not delay. tink not of d labour rather reflct on d completN.

Text: Kia Ora Hope u have a gd break. INFO101 lectures cover "Sys Development". You shd check up WS5 it may be something new for u. "Ka whati te tai ka pao te torea"

Text: B-)Do you know these Terms:TCP/IP, Domain Name, Client-Server, DSL, IPV6, DNS, DHCP, VoIP You will find ur answers in today's 101 lecture. TUT3 due Sunday.

Text: Kia Ora, 25 Days till 101Access Assig Due
D gr8 dividing line btwen success and failure can be expressed in five words; "I did not have time."~ Franklin F.

Text: Kia ora, reminder for info101, memba u have ur tutes this week, submission 2 is due, dont 4get 2 read case study "racing board" keep up the good work! ka kite

Text: kia ora katoa! best of luck for your info101 final exam! all the best and thank-you for being apart of this research. Aroha mai God bless, Po marie. :-)

Text: Kia Ora Kotou, no tutorials this week, member 2 attend all lectures & workshops so ur on top of access and this week topic. keep up the good work! Po marie:-)

Text: Hello,thank u 4 yor txt mesage n da remindr.Much apreciatd!Hv a gd day!Ka kite (reply).

Text: "In d PAST, nobody had a watch but evryone had time. Now evryone has a watch but NOBODY has time." ~Go for ur 101 lecture 2day and submit TuT5 by sunday~

Text: Kia ora Don't forget to prepare for INFO101 HTML Practical Test next week and submit your CyberCV by sunday. Is not too late to start working on it.:-]

Appendix 3

Students' Responses	MSLQ
"It's been good getting reminders, even if it's been like at the back of your mind that a weekly assignment is due for example, and you get a text message and you think that's right I have got to start that."	ER
"It is really helpful because you know you've got it due but you sometimes get so caught up in everything else that you forget to do it so getting the text is quite helpful."	TSEM
"The quotes and the lecture material that's more of a reminder of what we are doing that week just a reminder of the course material it's like, is that where we are up to now? It was really good to be told what we are doing for the week so that we can read up on it if we needed to. The reminders were most useful – of the lecture material, the most scary one was, there were 25 days due until the Access assignment was due. I was like are you serious is it that far away? That was quite a good one!"	ER/TSEM/TV
"I found like receiving them during the day often it would be a few hours before the lecture that would be good, just a reminder and I would be like yes I have to get organised to go to class."	OR/ER
"I think it helped with attending classes, I haven't missed a lecture maybe it was because of the texts or maybe it was me being a lot more motivated. I guess it helped having the reminders, some days you do feel like I don't wanna go to class then you have a reminder and you're like I guess I better go."	EGO/TSEM
"It kind of feels like you have someone watching you, so feel like you really should go."	EGO
"Yes I can definitely say I am more organised, just because we have the constant reminders."	OR/TSEM
"I thought it was really good, because I am doing four papers I always have assignments due so it really good to have the reminders , like go to classes , or get your submissions due on time, because you already have so many other things to worry about. So it was good."	ER/TSEM
"There was one cannot remember whether it was about HTML or Access, which was like "it's not too late to start you can do it." It made me smile."	IGO
"Yeah the messages were quite personal, which is better than getting nothing at all from anyone, telling you to hurry up and do your assignments. So yeah it was good."	IGO