Succeeding at junior high school: Students' reasons, their reach, and the teaching that h(inders)elps their grasp

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Highlights:

1. A study across first-year secondary school: math, native and foreign language classes.
2. Did not support reciprocal connections: intrinsic motivation and self-efficacy.
3. A pattern of intrinsic motivation and self-efficacy converging on achievement.
4. Externally-controlling experiences presented adaptive and maladaptive relationships with students' motivations/beliefs.
5. Reciprocal relationships for students' motivation/beliefs and instructional experiences.
6. A Mathew-effect between adaptive motivation-beliefs and quality of instruction experienced.

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Abstract

How do we support students through their difficult transition to secondary school? Perceived value for and perceived ability to be successful during secondary school are a crucial part of any answer to this question. These perceptions and their interaction with classroom instruction are at the heart of many issues students face in this challenging new learning environment. Seeking to address these issues head-on, the current study modelled the shared role of motivation (intrinsic/extrinsic) and self-efficacy beliefs within mathematics, native and foreign language achievement across first-year secondary school studies at six schools in Japan. Modelling included pre-post subject achievement and students' instructional experiences. Longitudinal latent structural equation modelling was undertaken for each of the subjects to examine the interplay between students' motivational and instructional experiences across one academic year. Findings support the shared role of intrinsic motivation and self-efficacy within achievement (βs = .1-..24), and reciprocal relationships between perceptions of instruction and students' motivations/beliefs (βs = .15-.21). Results also suggest different patterns of motivation-belief and motivation/belief-instruction interconnections across the three subjects researched. The pervasive role of instructional experiences for students' motivation-beliefs (from teaching to self-efficacy and intrinsic motivation, βs = .14-.20) highlight the

powerful role of teachers in these critical environments. Implications for theory and practice arising from the results and the integrative model utilised are discussed.

Introduction

While educational researchers continue to expand and refine our taxonomy of motivations and beliefs for learning at school, the bulk of our inquiries still flow from two simple questions all students face: "Why should I do this?" (their reasons or value for the task) and "Can I do this?" (their perceived reach or self-efficacy for succeeding in the task). Many major psychological theories address one of these questions effectively (e.g., Bandura, 1977; Connell, 1985; Deci & Ryan, 1985; Dweck, 1986; Weiner, 1985), but it is a less common paired focus for theoretical development (a well established exception; Atkinson, 1957; Eccles et al., 1983). During the past three decades, however, there has been a slow movement for researchers to integrate essential concepts from parallel theories into their research programmes, with perceived control and self-determination theories' cross-theoretical work being an excellent example (e.g., Skinner & Belmont, 1993). The current study built on these efforts through the test of a cross-theoretical integrated motivation-belief model, accounting for the reciprocal role of perceptions of teaching across students' first year at secondary school.

The importance of both value and ability-beliefs for the initiation and persistence of behaviour have long been recognised, with early efforts seeking to formulise their apparent multiplicative interactions (Atkinson, 1957). Research and reviews have since consistently pointed to the essential role of both motivation and ability-beliefs for

educational achievement (Pintrich, 1989; Pintrich, Marx, & Boyle, 1993; Wigfield, Cambria, & Eccles, 2012; Wigfield, Muenks, & Rosenzweig, 2015). Furthermore, classroom research (Black & Deci, 2000; Jang, Reeve, Ryan, & Kim, 2009; Skinner & Belmont, 1993; Skinner, Furrer, Marchand, & Kindermann, 2008; Skinner, Kindermann, & Furrer, 2009) and reviews of achievement motivation (Wigfield et al., 2012) have demonstrated the critical positive and negative roles of instruction for student motivation and engagement. Research has also noted variance in students' motivation across different subjects (e.g., Chanal & Guay, 2015), suggesting that students experience these learning environments very differently.

The current study brings this body of research together through the use of a well-established model for value with clear connections to the quality of instruction, self-determination theory's extrinsically and intrinsically regulated motivations (Deci & Ryan, 1985), an ability-belief construct with a strong connection to academic performance, social cognitive theory's academic self-efficacy (Bandura, 1986, 1997). To address the role of instruction within students' motivation, elements of instruction (autonomy-support, external control and structure) with strong theoretical ties to these motivations-beliefs have been included in the research design.

For an effective test of how these motivational, belief and instructional components reciprocate and converge on student learning in classrooms, a longitudinal, latent research design is necessary. Furthermore, as student motivation can vary strongly across different subjects, it is important to include, and therefore enable comparisons between, important school subjects. Finally, any test of student learning must include objective, longitudinal measures of student learning. Seeking to meet these criteria, the

present study tested the longitudinal interplay between students' "reasons" (value) for studying, students' perceived academic "reach" (self-efficacy) and perceived "quality of teaching" (experiences of instructional structure, autonomy-support and external control); as well as their convergence on their achievement outcomes (their "grasp" of curricula). This research was undertaken separately in foreign language, native language and mathematics classes, across students' crucial—and turbulent—first year at secondary school in Japan.

The present longitudinal tests aimed therefore to advance our understanding of the convergence of key motivations, beliefs and instructional experiences across essential subjects of school study. Rather than being limited to a single motivational or belief theory, the current study pursued a cross-theory and cross-school-subject design. This approach allowed us to draw on robust theoretical constructs and enabled comprehensive, reciprocal tests of the proposed integrative motivation/belief-instructional model.

Background

The beginning of secondary school is widely acknowledged as a challenging period, both developmentally (Steinberg, 1987) and, as a transition within formal education, academically. A large body of research has addressed the effects of this critical period in students' lives, working from the perspective of what students value in their school work and their expectancies for success (Eccles et al., 1983; Eccles & Midgley, 1989).

Some work has attempted to develop predictive, expectancy-value theory centred models for instructional elements (e.g., Wang & Eccles, 2013). However, the broad nature of the Eccles' expectancy-value theory (Eccles et al., 1983) does not put it in a strong position to support the framing of hypotheses regarding reciprocal interactions

between key elements of classroom instruction and students' motivations-beliefs for learning.

An alternative integrative model utilising value-motivations and ability-beliefs, along with perceived control theory's feedback loop for sustaining engagement (Skinner, 1995) has the potential to address questions of instructional quality and motivation-belief development across our often-impermeable theoretical boundaries. Working within this framework, from the perspective of instructional quality and behavioural/emotional engagement, Skinner and Belmont (1993) established reciprocal links between instruction and engagement over time. Students presenting greater behavioural engagement were found to receive more structure, autonomy-support and involvement from teachers. This reciprocal connection was hypothesised as potentially leading to a pattern of decline for less engaged students.

Building on the connections presented, the current study moved towards a testable model for the development and convergence of value and ability-beliefs. Utilising this model, the hypothetical relationships between elements of classroom learning environments, perceived control (ability-beliefs), and student motivation were tested. The proposed model employed elements from self-determination theory (SDT; Deci & Ryan, 1985) to include representations of value (intrinsic/external regulation); elements of social cognitive theory (Bandura, 1986, 1997) to represent ability-beliefs; and follows Skinner's integrative work (1990; 1995; 2017) on the intersection of instruction, perceived control and engagement. Taken together, these theories offer an integrated, testable, yet parsimonious model for the interaction between instruction, the convergence of students' motivations-beliefs, and their eventual role within achievement.

The following section will address the potential contribution these theories make together toward a better understanding of students' fundamental questions of *reasons* (operationalised as SDT's intrinsic and extrinsic value; i.e., "Why should I do it?"), *reach* (operationalised as Social Cognitive Theory's self-efficacy, i.e., "Can I do it?") and the instructor's potential role in supporting students in developing motivations-beliefs consistent with strong learning outcomes (operationalised as Autonomy-support, Structure and External control from SDT and Perceived Control Theory).

Self-determination theory perspective on students' reasons for learning

Within self-determination theory (Deci & Ryan, 1985), Organismic Integration Theory (OIT) was developed to describe the potential range of regulated motivation (i.e., across a continuum of lack—external—internal regulation) and how contextual factors might affect this regulation. Internally-regulated motivation relative to externally-regulated motivation, has demonstrated benefits for learning (e.g., Chanal & Guay, 2015; Vansteenkiste, Lens, & Deci, 2006; Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005). From a broad perspective, contexts that support an individual's psychological needs, in turn support increasingly internally-regulated motivation. More specifically, and as it relates to the present research, instructors and learning environments providing autonomy-support can encourage higher quality (more internally-regulated) motivation for school learning (Black & Deci, 2000; Jang et al., 2009; Oga-Baldwin, Nakata, Parker, & Ryan, 2017; Skinner et al., 2008).

A second SDT mini-theory with corollary relevance to the present research is the Cognitive Evaluation Theory (Ryan & Deci, 2017). Cognitive Evaluation Theory (CET) describes how interpersonal and environmental influences conspire to help or harm the

quality of an individual's motivation (as defined under OIT). This mini-theory specifies, among other hypotheses, that situations that support students' perceived competence can enhance internally-regulated motivation. Hence, CET provides a theoretical link between competence beliefs and internally-regulated motivation: i.e., how these key motivations and beliefs can be cross-linked during the learning process. It is important to point out here that while SDT does not provide an explicit theoretical cross-link back from intrinsic motivation to ability-beliefs, research in the area of interest offers such a connection. Intrinsic motivation is specified as an important component of interest and its development (Hidi & Renninger, 2006; Renninger & Hidi, 2011). Hidi and Ainley (2008) hypothesised that through interest's role within persistence that it was in fact an important antecedent of self-efficacy. Fryer and Ainley (2019) demonstrated that even after accounting for prior achievement and self-efficacy, and interest mediated through initial self-efficacy, that interest at the beginning of a course was an important direct predictor of future self-efficacy at the course's end.

In moving towards a hypothesised model for the current study, it is important to acknowledge that while SDT includes competence as a psychological need, SDT is not a theory directed at specifically modelling how human beings learn. SDT is instead focused on psychological well-being, and is therefore chiefly interested in how the satisfaction of competence (along with autonomy and relatedness) needs increase the quality of student motivation and well-being. SDT's implicit assumption, in the context of education, is that increased internally-regulated motivation will result in enhanced learning outcomes. In the current study, however, we were specifically interested in examining the longitudinal connections between instruction and student motivations-beliefs and then the

convergence of motivations and beliefs on students' learning outcomes—specifically achievement outcomes.

One theory that presents clear connections between the quality of instruction (i.e., structure) and ability-beliefs (i.e., perceived control) is perceived control theory (Connell, 1985; Skinner, 1990, 1995, 2017). Perceived control theory suggests that clear structure (i.e., instruction which brings learning tasks within students' perceived competency reach) in the learning environment can enhance students' beliefs in their capacity to successfully undertake a task. Thereby, this theory outlines how structure, mediated by ability-beliefs, increases the likelihood of students engaging in tasks in the first place and persisting with them in the longrun. As Skinner (1996) outlined, there are many related "control" constructs, with overlapping definitions, which each reflect some aspect of perceived control. Of the many constructs from this family of related research, self-efficacy beliefs and its related constructs, as one part of social cognitive theory (Bandura, 1986, 1997, 2012), has a strong connection to student achievement (Hattie, 2009; Richardson, Abraham, & Bond, 2012). Academic self-efficacy is the specific control belief that one has the capacity to successfully undertake a learning task. While self-efficacy is generally conceptualised at the task level, Bandura (2012) has suggested that self-efficacy is not limited to a single task, encompassing "[j]udgments of self-efficacy for pursuits like academic achievement, organisational productivity, entrepreneurship, and effecting social change encompass activities of broad scope, not just an isolated piece of work" (p.17).

Modelling instruction and student motivation-belief relationships

The current study is concerned with two lines of research examining the relationship between perceptions of instruction and students' motivations/beliefs about learning. The first line of research comes from the perceived control literature (Connell, 1985; Skinner, 1991, 1995, 1996, 2017). Skinner and colleagues' programme of research presents a model organising perceptions of structure within the environment as supporting an individual's belief regarding their ability to control their environment. This belief is hypothesised as affecting motivation and thereby engagement. Increased engagement is hypothesised as increasing actual competence, which then feeds back into a loop increasing perceptions of control predicting students' motivation which again predicts engagement. Structure in the learning environment is thereby specified as a key ingredient for classroom learning and its outcomes.

Initial (Skinner & Belmont, 1993) and additional (Skinner et al., 2008) empirical research seeking to combine autonomy-support and structure components of instruction (along with involvement) used the perceived control framework, examining the role of autonomy-support, structure, and involvement as increasing students' needs (autonomy, competence, and relatedness) satisfaction and thereby supporting engagement and learning outcomes. This programme of research indicated substantial relationships between students' perceived structure and behaviour, and students' perceived involvement with both their behaviour and emotion. Furthermore, reciprocal relationships were observed between students' emotional experiences and students' behaviour with their perceptions of instruction suggesting longitudinal interplay between these components of the classroom teaching-learning experience.

Following up on perceived control research, SDT researchers have undertaken a series of studies focused on bringing together and understanding the shared role of perceived autonomy-support and structure within student learning. Jang, Reeve, and Deci (2010) presented evidence indicating a substantial correlation between autonomy-support and structure perceptions. Regression-based findings indicated large separate and consistent relationships (based on effect size recommendations from Keith, 2015) for both components of instruction, as well as for self-reported and collective behavioural engagement. Based on their findings, Jang and colleagues suggested that structure and autonomy-support are complementary components of instruction.

Addressing the question of structure and autonomy-support pairing and their shared role within student learning processes and outcomes, Vansteenkiste and colleagues (2012) applied person-centred methods to analyse students' self-reported perceptions of instruction, motivation, learning outcomes and problem behaviours. A finalised four-cluster solution suggested that the pairing of autonomy-support and structure was characterised by the most positive pattern of the constructs assessed. Other studies have found a strong relationship between autonomy-support and structure. Sierens and colleagues (2009) found high correlations between the two factors, but also found some differential effects on school outcomes. Other studies have had difficulty separating the two constructs, finding more reliable effects using a single construct called *supportive structure*, representing generalised instructional support (Oga-Baldwin & Nakata, 2015). Taken together, these studies indicate that autonomy support and structure are highly, perhaps indelibly, linked as constructs.

A programme of research within Japanese elementary schools has recently added to this area of inquiry. Oga-Baldwin and colleagues (Oga-Baldwin & Nakata, 2015; Oga-Baldwin et al., 2017; Oga-Baldwin & Fryer, 2018) sought to assess the effects of national reforms to the foreign language curricula in a sample of Japanese elementary schools, indicating that students' more internally-regulated motives were related to their engagement in class, and were predicted by a high degree of autonomy-support and structure (Oga-Baldwin et al., 2017). A follow up study over the course of two years indicated that students consistently moved toward better quality motivational latent subgroups (Oga-Baldwin & Fryer, 2018b). The overall research programme suggests that the new national curriculum is having positive effects on the quality of students' motivation for studying foreign languages. While these findings offer clear and positive results for English during elementary school studies, the longer-term effects after moving into secondary school (for English and other important subjects of study) and beyond have yet to be addressed.

The current study

In this study, we examined the reciprocal connections between secondary school students' instructional experiences with their motivations and beliefs for learning, and school achievement. The Japanese education system is a useful and interesting context for testing these relationships. Japanese students are noteable for generally achieving a very strong grasp of fundamentals by the end of secondary school (OECD, 2016), and the Japanese national curriculum is notable for its relative uniformity of outcomes (Tsuneyoshi, 2004).

Consistent with Western education, Japan's primary schools provide a nurturing environment where students are expected to develop both a grasp of fundamentals and a love of learning. This is in contrast to secondary schools, which are more focused on achievement and success on high-stakes standardised examinations, with a stricter attitude towards conformity and compliance (Oga-Baldwin & Fryer , 2018a). As might be expected, Japanese primary schools can have a positive effect on student motivation (Oga-Baldwin & Fryer, 2018b), but secondary (Nishimura & Sakurai, 2017) and later tertiary education (Fryer, 2017) may have negative effects.

For our examination of the interaction between instructional experiences and motivations/beliefs for learning the current study reaches beyond a single framework (e.g., EVT, SDT or Social Cognitive Theory), and instead seeks to combine powerful elements of multiple theories of human motivation that are recognized across cultural boundaries. By so doing, we focus on motivations/beliefs to learn and instructional experiences that support this development. As of yet, no empirical studies indicating a culturally specific framework for exploring the interplay between instruction, motivation, and ability beliefs has yet been tested or validated using effective cross-cultural methods, nor has work been forthcoming on the differential effects of culture on specific school subjects. In this study, we have used existing constructs with a history of strong validation procedures in multiple cultural settings (Bandura, 2012; Jang et al., 2012; Chanal & Guay, 2015; etc.) and then organised these constructs in a manner consistent with perceived control theory (Connell, 1985; Skinner, 1991, 1995, 1996, 2017).

The current study builds on Oga-Baldwin and colleagues' work and other burgeoning research programmes in the specific context of Japanese elementary and

tertiary education examining engagement and perceptions of teaching (Oga-Baldwin et al., 2017), students' internally/externally regulated reasons for studying (Fryer, Carter, Ozono, Nakao & Anderson, 2013; Fryer, Ginns & Walker, 2014; Fryer, 2015; Fryer, Van den Broeck, Ginns, & Nakao, 2016), the development of students' intrinsic and extrinsic motivations for study at school (Oga-Baldwin and Fryer, 2018b), the interplay between instruction and learning (Fryer & Ginns, 2018) and self-efficacy (Fryer & Ainley, 2019; Fryer & Oga-Baldwin, 2017; Fryer, Ainley, & Thompson, 2016). These studies have successfully validated North American constructs in East Asian contexts, and thus built the foundation for an integrated model of motivational development across multiple school subjects.

This study adds to the research on the development of motivation in three important ways. First, the current research was an opportunity to simultaneously examine students' motivation and instructional experiences within three core subjects of study (i.e., the same students studying mathematics, foreign and native languages). Students' motivations have been found to vary across subjects of study (see Wigfield et al., 2015; Chanal & Guay, 2015), but little is known about whether this is related to different instructional experiences and/or the motivations/beliefs/prior knowledge students bring with them. Second, the current study aimed to expand the theoretical scope of research both in Japan and internationally by including ability beliefs as well as motivation as outcomes of students' perceptions of instruction (autonomy-support, structure and external-control). Finally, the current study's longitudinal design makes it possible to assess potential reciprocal connections between students' learning experiences (i.e., motivations for and beliefs about learning) and the teacher instruction they experience.

Reciprocal connections have been observed within North American elementary school (i.e., structure predicting behavior predicting structure; Skinner & Belmont, 1993) and Japanese tertiary students (i.e., perceptions of teaching quality predicting deep approaches to learning predicting perceptions of teaching quality; Fryer & Ginns, 2018) suggesting these reciprocal relationships cross national and educational boundaries.

The aim of this design was to build on our understanding of the interaction between instruction and students' motivations/beliefs for learning and to explicate their potentially convergent role within students' learning outcomes (see Figure 1 for overall design and proposed model test). To enable a comprehensive test of the proposed model, the current study was undertaken separately within three subjects of concurrent study (mathematics, foreign and native languages) across three semesters (one academic year). Furthermore, the current study was designed to test reciprocal connections between students' initial intrinsic motivation and extrinsic motivation (as measured in its most extreme form external regulation) and beliefs (self-efficacy), perceptions of instruction (autonomy support, structure, and external control) and the same motivations/beliefs at the end of the academic year. Due to the complexity of the latent models tested, the internally and externally regulated poles of the OIT continuum were selected to represent students' motivation for learning across the academic year. Consistent with past research (Oga-Baldwin & Nakata, 2015) autonomy-support and structure were combined to assess overall "good teaching" or well-structured and autonomy-supportive instruction.

Figure 1 presents two waves of students' motivations (intrinsic and extrinsic) and beliefs (self-efficacy), separated by eight months (Times 1 and 4). As discussed to this point, SDT (Deci & Ryan, 1985) and research focused on interest development (Fryer &

Ainley, 2019; Hidi & Ainley, 2008) suggest reciprocal connections between intrinsic motivation and self-efficacy over time. Few studies have, however, effectively tested these hypotheses. At Time 3, between the two measurements of motivation and belief, key aspects of students' instructional experiences were assessed: Teaching (autonomy-support and structure) and external control. Prior theory and empirical research has suggested reciprocal links between students' positive instructional experience and students' motivations (Skinner & Belmont, 1993). Furthermore, CET (Deci & Ryan, 1985) describes the potential negative effects of externally controlling experiences; however, reciprocal connections with self-efficacy have not to our knowledge been found. The present model therefore provides an opportunity for replication and extension in this area of research. Pre-post achievement provides a controlled environment to test the role of motivation and self-efficacy within school achievement. Both intrinsic motivation (Oga-Baldwin et al., 2017; Vansteenkiste et al., 2009) and self-efficacy (Bandura, 1993) have presented consistent relationships with achievement in past research, the present study is therefore an opportunity to retest these critical connections to key observed outcomes.

For all longitudinal modelling (Figure 1), students' sex was controlled for by including it as a predictor of all latent and observed variables modelled. It is important to control for the sex of participants for longitudinal tests of achievement such as those conducted in the current study, but it is particularly vital in the context of individual differences like motivations and beliefs such as those examined here (see Voyer & Voyer, 2014). The present study, however, had no specific research questions with regard to the role of sex within the models tested.

==========Figure 1 About Here==========

The study was undertaken in the context of six Japanese secondary schools, across students' crucial first year. The current study draws on theory developed and chiefly validated in western context (SDT, Social-cognitive theory, Interest development, and Perceived control theory). However, all constructs utilized in the current study have been validated and tested in recent research carried out within Japanese educational contexts. This research indicated that in the context of Japanese eduction, that both the measurement of and relationships between these constructs are consistent with theory and use in western educational settings. The present study did not therefore set out cross-cultural hypotheses, but instead focused on the development and test of a cross theoretical model across three subjects of study in a critical period of education (first year of secondary school). The next section presents this study's specific aims and research questions.

Aims

The current study was conducted in three separate subjects (mathematics, foreign and native languages) with the same sample of students. This study aimed to address six research questions regarding the reciprocal connections between students' motivation-beliefs for learning, their instructional experiences and achievement.

First, the current study aimed to test hypothesised cross-lagged predictive connections (suggested by SDT–Deci & Ryan, 1985–where increased ability beliefs are hypothesised as supporting motivation) from self-efficacy (T1) to intrinsic motivation (T3) across math, native and foreign language subjects (Research Question 1). Reciprocal relationships were expected from internally-regulated motivation to self-

efficacy based on intrinsic motivations important role within interest which, through enhanced persistence, is an important predictor of self-efficacy (based on Ainley, Buckley, & Chan, 2009; Fryer & Ainley, 2019; Hidi & Ainley, 2008) (Research Question 2). Working from Skinner and Belmont's (1993) engagement and instruction modelling, we expected reciprocal connections between experiences of instruction and students' motivation/beliefs for learning. Specifically, we expected students presenting higher intrinsic motivation and self-efficacy for learning to experience higher quality instructional experiences (i.e., more structure and autonomy-support), and reciprocally for higher quality teaching to predict increased intrinsic motivation and self-efficacy beliefs (Research Question 3). Based on the literature reviewed (SDT's CET; Deci & Ryan, 1985), we expected students' experiences of external control to predict extrinsic motivation for each subject, but no hypothesis regarding reciprocal relations could be constructed (Research Question 4). Prior achievement was expected to predict self-efficacy (Bandura, 1993), but no hypotheses regarding connections to students' future intrinsic and extrinsic motivation could be formed, leaving it an open question (Research Question 5). After accounting for prior achievement, future achievement was expected to be predicted primarily by academic self-efficacy (Bandura, 1993) and secondarily by intrinsic motivation (Oga-Baldwin et al., 2017; Vansteenkiste et al., 2009) (Research Question 6). Finally, without prior research to construct a hypothesis, the difference in the predictive relationships between the three subjects examined was unclear, but an important area of exploration for future theory building.

Materials and Methods

Participants and context

The current study was undertaken with one group of first-year secondary school students in Japan (n = 669; Male = 337; Female = 332). Six schools located in two rural-suburban districts agreed to participate in the study. While the schools were a convenience sample, being located in the same area as the researchers' universities, it is worth noting that the mean household income per month in the two districts (¥465,000 and ¥459,000) was consistent with the national average (¥461,000) (No Author, 2018). Participating students were all ethnically and culturally Japanese, speaking Japanese as a home language, and had completed six years of compulsory primary education. Japanese school enrollment policy is decided by age cohort; students who repeat a school year are extremely rare (Tsuneyoshi, 2004). Accordingly, all student participants can be assumed to have been born between April 2, 2003 and April 1, 2004 (age 12–13 at the time of the study). Student participation was voluntary, and parents were notified regarding student involvement in the study by the participating schools. All students and parents in the district consented to participate; at no point did individuals raise concerns or refuse participation. Non-participation due to absence on survey days was minimal (missing individuals < 2% over all three time points).

The study spanned the three semesters (one academic year) of students' study in three core subjects: mathematics, native language (Japanese) and foreign language (English). The principal research instruments were surveys that students completed during class time on three separate occasions. Students' semester-end achievement (semester 1 and semester 3) was obtained from the participating schools and included in

the latent modelling. Data collection was undertaken separately for each of the subjects under investigation. Figure 1 presents the overall research design and model for subsequent test within each subject examined.

Procedures and Ethics

Schools were recruited in coordination with local boards of education. Participating principals volunteered to have their schools join the study, and agreement was obtained from all participating teachers. Student participants were informed of the scope and aims of the study before agreeing to participate with signed permission forms. Students were each assigned a tracking number for the course of the study. All surveys were completed on paper and data was scanned and cleaned upon receipt. Motivation-belief surveys were administered during the first term of the 2016-2017 school year, two times and eight months apart, at the beginning and end of the academic year (Times 1 and 4). Teachers then submitted anonymized semester grades to the researchers via password encrypted USB at Time 2. Surveys on the teachers' instructional practices were conducted during the second semester, six months after the first motivation surveys (Time 3). The Time 1 and Time 3 round of surveys were conducted under the oversight and direction of the researchers together with students' teachers, while the Time 3 motivation surveys were conducted by the teachers and submitted to the researchers via post. Surveys were completed during class time for the subject in question (i.e., mathematics class for the mathematics survey). Surveys took roughly 15 minutes to complete. Final grades for the year were then submitted at Time 5, again via encrypted USB and cross-referenced with student tracking numbers. Ethical oversight was included in the review process for the JSPS Grant-in-aid for Scientific Research. Permission to undertake the study was granted

from the Fukuoka University of Education Ethics Review Board.

Instrumentation

The current study pursued a variable-centred longitudinal, quantitative model of inquiry. Motivations and achievement were each measured twice, with perceptions of instruction being measured once. Survey instruments for the current study were both drawn from international research and developed through research in the context of Japanese primary (Oga-Baldwin & Nakata, 2015; Oga-Baldwin, et. al., 2017) and Japanese higher education (Fryer & Ainley, 2019; Fryer, Ainley, & Thompson, 2016; Fryer & Anderson, 2012).

Self-efficacy was assessed by using a translations of Pattern of Adaptive Learning Scales, (e.g., "I'm certain I can master the skills taught in class this year"; Midgley et al., 2000). This scale has recently been used in Japan in tertiary (Fryer & Ainley, 2017) and secondary schools (Fryer & Oga-Baldwin, 2017), demonstrating acceptable discriminant validity and reliability in this context.

The self-regulation questionnaire was employed to assess students' motivation (e.g., intrinsic regulation: "I enjoy learning mathematics / Japanese / English"; external regulation component of extrinsic motivation: "I have no other choice but to learn mathematics / Japanese / English"; Ryan & Connell, 1989). The Japanese version employed was adapted for and has seen substantial recent use in Japanese elementary school educational research (e.g., Oga-Baldwin & Nakata, 2015; Oga-Baldwin, et. al., 2017). Students' instructional experiences were assessed with three scales. From perceived control theory, structure (Teacher as a social context, e.g., Structure: "My teacher makes sure I understand before he/she goes on"; Belmont, Skinner, Wellborn &

Connell, 1988) was employed to assess students' experiences of teacher support for students' ability beliefs. From SDT, autonomy-support (Adapted from Teacher as a social context, e.g. "My teacher encourages me to ask questions") and external control (Controlling Teacher Questionnaire, e.g. "My teacher tries to control everything I do"; Jang et al., 2009) employed to assess students' experiences of teacher support or obstruction of students' internally regulated motivation. For the current study Autonomy-support and Structure scales were combined to create a Teaching Quality construct (referred to as Good Teaching from here on) utilised within each of the three models tested. The instructional experience scales have previously been successfully utilised in both Japanese tertiary (Fryer & Anderson, 2012) and elementary (Oga-Baldwin & Nakata, 2015; Oga-Baldwin, et. al., 2017) educational contexts.

All items and the range of their respective factor loadings across the time points and the three subjects researched are presented in the appendices (see Table 6). In the previous research this study builds on, all scales were translated and back-translated by both a native and non-native bilingual researcher. Inconsistencies were resolved through discussion (Brislin, 1980). Instruments have previously shown acceptable longitudinal reliability (Oga-Baldwin et al., 2017; Fryer & Ainley, 2019). An additional analysis of the reliability and (convergent and divergent) construct validity of the scales employed in the current study (Japanese translations included) has recently been published and is available for open access download (Fryer & Oga-Baldwin, 2018). All items were presented for self-report as a cummulative scale from one (nothing like me) to six (exactly like me).

Analyses

The current study pursued longitudinal latent variable-centered modelling to address this study's six research questions. Missing data were assessed prior to analyses (< 2% data volume). Missing data were coded and then accounted for by Full Information Maximum Likelihood estimation within M*plus* 7.4 (Muthén & Muthén, 2014).

Analyses began by calculating descriptive statistics and composite reliability (Raykov's Rho; Raykov, 2009) for all latent variables. We then assessed divergent and convergent construct validity through Confirmatory Factor Analyses for each model in math, native and foreign language subjects. Acceptable Confirmatory Factor Analyses (CFA) fit was determined through the use of multiple indices: CFI values > .90 (McDonald & Marsh, 1990), RMSEA values < .08 (Browne & Cudeck, 1992) and SRMR value < .08 (Hu & Bentler, 1999). For all latent analyses, the inherently nested quality of the data, wherein participants are nested within classes, was accounted for using cluster-robust standard errors with M*plus*. This approach was used because the number of level 2 clusters was insufficient to prevent bias (< 50; Maas & Hox, 2005). For this analysis, each individual homeroom was treated as a cluster.

Configural CFA was followed by invariance testing for all longitudinal latent variables for each subject. The assumption of invariance is tenable if CFI does not change more than .01 and the RMSEA increases by < .015 for the invariant model (Chen, 2007). Analyses concluded with cross-lagged latent modelling for each subject as described in Figure 1. To support interpretation of the structural equation modelling's β coefficients, we followed Keith's (Keith, 2015) suggested guidelines for the interpretation of beta coefficients in research for influences on learning were followed: βs below 0.05 are "too small to be considered meaningful;" those above 0.05, but less than 0.10 are "small but

meaningful;" those above 0.10, but less than 0.25 are "moderate"; and those above 0.25 are "large."

Results

Descriptive and Reliability Findings

Means and standard deviations for variables in each of the three subjects examined are presented in Table 1. Students' intrinsic motivation and self-efficacy were at or near the scale midpoint (i.e., 3.5). Extrinsic motivation was slightly below the mid-point (~ 3.0). Consistent with the latent longitudinal modelling of the variables, Raykov's Rho composite reliability was calculated for all latent constructs (Table 1). Each latent constructs' composite reliability was acceptable (Devellis, 2012).

==========Table 1 ABOUT HERE==========

Configural, Invariance, and Longitudinal SEM Fit

Confirmatory Factor Analyses for all latent variables (for each subject) resulted in good fit to the data from each subject (see Table 2), suggesting sufficient construct validity for the latent variables modelled. Invariance testing results confirmed that invariance was tenable for constructs in each of the subjects under investigation (Table 2). These results supported pursuing cross-lagged modelling in each of the subjects under investigation.

==========Table 2 ABOUT HERE==========

Latent SEM Results for Math, Japanese and Foreign Languages

The correlations of the researched variables for each subject were calculated and reviewed (see Appended Tables 3, 4, 5), but due to limited space are not discussed here.

A test of the hypothesised longitudinal model (Figure 1) for each subject resulted in acceptable fit (Table 2). Figures 2, 3 and 4 present the finalised longitudinal models with statistically significant ($p < .05$) and non-significant βs presented. Each of the three subject-based modelling results will be reviewed: mathematics, native and then foreign language findings. Modelling results begin with T1 motivations-beliefs βs for semester one grades (T2). This is followed by auto-lagged findings and cross-lagged motivation-belief statistically significant connections (T1-T4; Research Questions 1 and 2). Next the βs to and from students' perceptions of instruction are reviewed (Research questions 3 and 4). Next, the βs for semester one grades and then βs for these grades to T4 motivations-beliefs (Research question 5). Finally βs for semester three grades are reviewed (Research question 6).

Mathematics modelling results.

The cross-lagged model for students' experiences across one year of mathematics classes is presented in Figure 4. Self-efficacy was not significant ($p < .05$) and intrinsic motivation was a moderate ($\beta = .24$) predictor of semester one achievement. The auto-lagged relationships were all large with the smallest β (.43) connecting T2-T4 self-efficacy. No significant cross-lagged βs between students' T1-T4 motivations and beliefs were found. Students' perceptions of instruction (Math Good Teaching = well-structured and autonomy-supportive instruction) was predicted by students' sex (female = 1; male = 2: $\beta = -.10$). Self-efficacy beliefs ($\beta = .27$) and intrinsic motivation ($\beta = .15$) presented strong and moderate βs respectively for future Math Good Teaching, but neither significantly predicted externally controlling teaching.

Students' perceptions of instruction presented a range of moderate to large βs. Math Good Teaching moderately predicted T4 self-efficacy (β = .21) and presented moderate βs for intrinsic (β = .19) motivation. Perceptions of externally controlling teaching presented two moderate βs for students' self-efficacy (β = .10) and extrinsic (β = .13) motivation. Semester one grades only predicted one T4 motivation-belief, moderately predicting students' self-efficacy (β = .14) and externally controlling teaching (β = -.13). Student semester three grades were moderately predicted by both self-efficacy (β = .13) and intrinsic motivation (β = .10), as well as strongly by their achievement in semester one (β = .62). Variance explained for students' motivations-beliefs were moderate (R^2 =.36 -.47), small for semester one achievement (R^2= .10) and more substantial for semester three achievement (R^2= .44).

==========Figure 2 about here==========

Native language (Japanese) modelling results.

The cross-lagged model for students' experiences across one year of native (Japanese) language classes is presented in Figure 3. For native language studies, students' sex was a moderate predictor of both intrinsic motivation (female = 1; male = 2: β = -.19) at T1 and grades (female = 1; male = 2: β = -.19) at T2. Self-efficacy beliefs (β = .15) and external regulation (β = -.11) were significant moderate predictors of semester one achievement. The auto-lagged effects were all large with the smallest β (.39) connecting T1-T4 self-efficacy. The only cross-lagged effect between students' T1-T4 motivations and beliefs was moderate (β = .12) from intrinsic motivation to self-efficacy. Self-efficacy beliefs (β = .21) and intrinsic motivation (β = .16) presented moderate βs

respectively for future Japanese Good Teaching, but neither significantly predicted externally controlling teaching.

Good teaching (autonomy-supportive and well-structured) moderately predicted T4 self-efficacy (β = .19) and presented a moderate β for intrinsic (β = .20) motivation. Perceptions of externally controlling teaching presented no statistically significant βs. Semester one grades predicted two T4 motivations-beliefs with moderate to small βs: self-efficacy (β = .15) and extrinsic (β = .09) motivation. Student semester three grades were moderately predicted by self-efficacy beliefs (β = .11), as well as their achievement in semester one (β = .73). Variances explained for students' motivations-beliefs were moderate (R^2 = .37-.48), small for semester one achievement (R^2= .19) and more substantial for semester three achievement (R^2= .55).

==========Figure 3 about here==========

Foreign (English) Language modelling results.

The cross-lagged model for students' experiences across one year of Foreign (English) language classes is presented in Figure 2. Students' gender presented small βs for semester one (female = 1; male = 2: β = -.07) and semester three (female = 1; male = 2: β = .05) achievement. Both self-efficacy (β = .22) and intrinsic motivation (β = .24) were substantial predictors of semester one achievement. The auto-lagged effects were all large with the smallest (β = .38) connecting T2-T4 self-efficacy. There was one statistically significant cross-lagged connections between the motivation and belief constructs across the academic year: intrinsic motivation to self-efficacy (β = .10). Students' T2 (β = -.07) and T5 achievement (β = .05) were predicted by students' sex (female = 1; male = 2). T1 self-efficacy beliefs presented large (β = .29) and moderate βs

(β = -.17) for future foreign language Good Teaching and controlling teaching experiences respectively.

Students' perceptions of instruction presented moderate βs. Good foreign language teaching (well-structured and autonomy-supportive instruction) predicted T4 self-efficacy (β = .14) and intrinsic motivation (β = .15). Perceptions of externally controlling teaching presented moderate and small βs for students' extrinsic (β = .15) motivation and self-efficacy (β = .07) respectively. Semester one grades moderately predicted students' self-efficacy (β = .21), intrinsic (β = .13) motivation. Students' semester three grades were only predicted by their achievement in semester one (β = .69). Variance explained for students' motivations-beliefs were moderate (R^2 = .26-.44), small for semester one achievement (R^2= .12) and more substantial for semester three achievement (R^2= .59).

==========Figures 4 about here==========

Cross subject exploration.

Consistencies and marked differences between three subject-based models are outlined here, the latter undertaken in the same order as the individual modelling results. The three models presented to this point were, despite the very different domains of study, consistent in many of their longitudinal connections. All three models presented strong auto-lagged connections, with achievement and motivations presenting the largest relationships, and self-efficacy beliefs being the smallest. In each model, initial self-efficacy and/or intrinsic motivation were moderate predictors of semester one grades. Semester one grades in turn predicted subsequent self-efficacy for all subjects, intrinsic motivation only foreign languages, extrinsic motivation only native languages. For all

three subjects, good teaching (autonomy-supportive and well-structured) was positively predicted primarily by prior self-efficacy beliefs and secondarily by intrinsic motivations. In turn, good teaching presented moderate predictions for future self-efficacy and intrinsic motivation. Externally controlling teaching presented a wide variety of connections across the three models, suggesting its role within students' beliefs as being particularly subject-specific. Across the three subjects, semester one grades were a powerful predictor for future achievement.

For the foreign language subject model, the most distinctive component was the complete lack of a statistically significant longitudinal relationship between the motivation-belief variables and semester three achievement. This relationship might be partially explained by potential mediation from larger βs from T1 motivations-beliefs to and through T2 achievement.

Students' native language classes were marked by a complete lack of a statistically significant relationship between perceived externally controlling teaching and students' motivations for learning. In contrast, in students' mathematics and foreign language classes, perceptions of controlling teaching were positively connected to both students' extrinsic motivation and self-efficacy beliefs.

Discussion

The current study examined Japanese first-year, secondary school students' motivations and ability-beliefs for learning in three core subjects of study (mathematics, native and foreign languages) across one academic year. This study expanded on a tradition of work in North American secondary schools (beginning with studies such as Eccles et al., 1983) and recent research in the context of Japanese primary schools (Oga-

Baldwin et al., 2017). Pre-post achievement and students' instructional experiences for each subject were measured, permitting the test of a latent cross-lagged model for each subject. The current study addressed six specific research questions, alongside the broad theoretical aim of extending our understanding of the interplay between students' instructional experiences and their motivations-beliefs for studying.

Inconsistent with the CET (Deci & Ryan, 1985) based hypothesis that ability-beliefs would support increased intrinsic motivation, no cross-lagged statistically significant β from academic self-efficacy to future intrinsic motivation was observed (Research Question 1). This may indicate key theoretical differences between competence need satisfaction and self-efficacy beliefs. Conversely, the supposition that intrinsic motivation, as an important component of interest (Hidi & Renninger, 2006; Renninger & Hidi, 2011), which predicts persistence and thereby enhances self-efficacy (Ainley et al., 2009; Fryer & Ainley, 2019; Hidi & Ainley, 2008), was supported for both native and foreign language studies (Research Question 2). Self-efficacy did, however, present a somewhat unexpected negative relationship for extrinsic motivation (foreign language studies). Furthermore, self-efficacy positively predicted students' experiences of good teaching (autonomy-supportive and structuring instructional experiences) in all three subjects, and also negatively predicted externally controlling teaching in the case of foreign language classes. It is reasonable to suggest that a small, mediated effect on future intrinsic motivation might arise from these links with supportive-structured teaching (Research Question 2).

Addressing a focus of the current study—the reciprocal interplay between experiences of supportive-structured teaching and students' motivations-beliefs for

learning—robust connections, were observed for each subject (Research Question 3). For all three subjects, students' prior intrinsic motivation and self-efficacy positively predicted future autonomy-supportive and structured instructional experiences. Reciprocally, in all three subjects, these Good Teaching experiences then predicted future self-efficacy and intrinsic motivation (Research Question 3).

In foreign language classes alone, prior self-efficacy predicted less externally controlling teaching. Extending this finding to foreign language and mathematics classes, experiences of externally controlling teaching presented mixed positive predictions: both extrinsic motivation and self-efficacy. Suggesting a kind of parallelism between foreign language and math classes (observed and perceived ability beliefs), externally controlling teaching was negatively predicted by achievement in math classes (Research Question 4). Prior achievement consistently predicted future self-efficacy for each subject, and intrinsic motivation (foreign language) as well as extrinsic motivation (native language) in some cases (Research Question 5). Achievement was predicted at two stages (T2 and T5). At T2 academic self-efficacy beliefs and/or intrinsic motivation both presented unique moderate βs for each subject. Accounting for T1 motivations and beliefs moderated by T2 achievement, T5 achievement was significantly predicted moderately by βs from intrinsic motivation and academic self-efficacy beliefs for mathematics, and only academic self-efficacy beliefs for native language studies. No predictive relationship for foreign language studies was found (Research Question 6).

At least four cross-subject findings are important to note at this point. The first is the counter-intuitive positive prediction of externally controlling teaching for future self-efficacy beliefs in foreign language and mathematics classes. The second connected point

is the resulting reciprocal relationship in foreign language classes (self-efficacy beliefs negatively predicted controlling teaching, which positively predicted self-efficacy beliefs), and similar, more complicated set of reciprocal links beginning with T2 achievement negatively predicting externally controlling teaching for math classes. The third point was the very different, statistically significant roles of gender across the three subjects. Female students presented more intrinsic motivation and higher initial achievement in native language classes, experienced better teaching in mathematics classes and higher initial achievement in native language classes. Finally, across each of the models examined, students' intrinsic motivation and academic self-efficacy beliefs presented a clear reciprocal relationship with good teaching experiences (autonomy-supportive and structuring). This motivation-belief pairing also often shared predictive relationships with achievement T2 and T5, suggesting an important convergent role for these motivations and beliefs on learning in the current study.

Implications for Theory

The higher-order construct based on these two elements of students' instructional experiences (autonomy-support and structure) formed a "good teaching" construct, which was a useful measure of students' positive teaching experiences and an important predictor of adaptive motivations and beliefs for learning. Furthermore, this measure of positive instructional experiences was reciprocally predicted by students' exhibiting more initial intrinsic motivation and self-efficacy for studying all three of the subjects researched.

The cross-lagged links between self-efficacy and intrinsic motivations presented theoretically mixed findings. First, CET suggests that through competence needs

satisfaction, that enhanced ability-beliefs supports enhanced motivational quality (i.e., intrinsic motivation). However, no such cross-link was evident (i.e., self-efficacy predicting intrinsic motivation) in any of the three subject models tested, indicating an empirical difference between competence needs satisfaction and self-efficacy. The opposite theoretical cross-link—i.e., intrinsic motivation (as a component of interest) increases persistence which yields increased self-efficacy due to sustained engagement—was present for foreign and native language studies, but not mathematics. As reciprocal links have been observed in interest/self-efficacy research (e.g., Fryer & Ainley, 2019), the missing self-efficacy direct prediction for future intrinsic motivation in the current study might be due to this operationalisation of intrinsic motivation as task enjoyment. The broader focus of interest (i.e., inclusive of value, emotional and epistemological components), of which intrinsic motivation is theorised to be an important component (Hidi & Renninger, 2006; Renninger & Hidi, 2011), might be the reason for the reciprocal link found in previous studies (Fryer & Ainley, 2019), but not in the current study. The current results suggest that intrinsic motivation can support self-efficacy, but unlike previously observed reciprocal links to interest (Fryer & Ainley, 2019), self-efficacy did not significantly (directly) predict future intrinsic motivation.

The reciprocal link between students' self-efficacy beliefs and intrinsic motivations and the supportive-structured Good Teaching students' later experienced were robust across all three subjects. This is consistent with Skinner and Belmont's (1993) engagement findings, buttressing their supposition that teachers provide more support to the students already motivated/engaged, rather than the students who might be in greater need of the support.

Of the three subject models tested, mathematics presented perhaps the most subject-specific pattern of interconnections. Mathematics was the only subject for which initial intrinsic motivation was not a predictor of future self-efficacy beliefs. This suggests that unlike in students' native and foreign language classes, that liking and enjoying math might not be a meaningful support for self-efficacy development. The second mathematics specific pathway was the negative prediction of externally controlling teaching by T2 achievement, paired with externally controlling teaching's positive prediction of T4 self-efficacy beliefs. At the same time, the T2 achievement point also positively predicted T4 self-efficacy beliefs. This suggests the teachers might have been addressing perceived lower grades with more external control. Consistent with SDT, external control predicted an increase in extrinsic motivation. Well outside the boundaries of what SDT would predict, experiences of externally controlling teaching also predicted students' self-efficacy for learning.

Foreign language classes presented some alignment with this partially maladaptive reciprocal connection between self-efficacy beliefs and experiences of externally controlling teaching. In foreign language classes, students' prior self-efficacy beliefs negatively predicted externally controlling teaching which in turn positively predicted future self-efficacy beliefs. Here, teachers might be reacting to perceived strengths in students' competency by exerting less control over their learning, which was connected to increased self-efficacy beliefs for the students (as well as extrinsic motivation).

It is key to point out that in the foreign language and mathematics classes, externally controlling teaching supported self-efficacy right alongside high quality

instructional experiences (autonomy-support and structured teaching). The tentative implications for theory based on these findings are first that while teachers do not appear to be reacting to low intrinsic motivation and self-efficacy beliefs by providing increased supportive-structuring instruction as might be hoped. Instead, teachers might be reacting to higher grades (math) and projected self-efficacy (foreign language studies) by applying less externally controlling teaching. The present results therefore imply that externally controlling teaching can support maladaptive motivation, as theory would suggest (i.e., extrinsic motivation; SDT's CET, Deci & Ryan, 1985), while at the same time also supporting increased self-efficacy beliefs (a less often discussed connection). This is an important area that is badly in need of further exploration in order to continue to clarify the cross-theoretical connections between ability-beliefs, motivations for learning and instructional experiences.

Implications for Practice

Teachers need to be made aware of the potential Matthew-effect supported by the apparent pattern of positive reciprocal effects between instruction (structuring and autonomy-supportive) and adaptive motivations-beliefs. It is easy to understand how teachers might preferentially support their best motivated students. For that reason teachers need to be supported in developing targeted strategies that ensure sufficient motivation and ability-belief support is given to students who need it most, especially across this critical first year at secondary school.

In contrast to the apparent Mathew Effect for students with high intrinsic motivation and self-efficacy, findings in the mathematics and foreign language classes indicated that teachers might be reacting to grades and projected self-efficacy by exerting

less external control over students' learning. This increased external control, unlike the increased supportive and structuring of student experiences, presented both adaptive and maladaptive predictive relationships. The practical questions regarding how teachers appear to have reacted to students are A) Are the teachers aware of how they reacted?; B) In what situations and with what kind of students might increasing (or decreasing) external control be helpful overall?; and C) What culturally appropriate, subject specific training can adjust how instructors react to students' apparent motivations, beliefs, and observed achievement (Cheon, Reeve, & Moon, 2012; Cheon, Reeve, & Song, 2018)?

Focusing on the general context of year-one secondary school and the specific context of Japan's system of education (but also relevant to other educational contexts, especially in Pacific Asia), two further practical issues are worth mentioning. The present research suggests that for teachers to meaningfully support students across students' first year of secondary education, they need to understand the important paired role of motivational quality and self-efficacy for student learning outcomes. As focused as many teachers are on managing the relatively large student numbers in classrooms (often as many as 40 students; Cave, 2016), handling after school duties such as students' sports clubs and the many other pressures related to their positions, it is easy to see how students' motivations and beliefs might slip off of teachers' radars. Instruction needs to address these important factors for learning along with the competencies necessary for high school and university entrance examinations—tests that have come to define secondary school experiences in Japan (Oga-Baldwin & Fryer, 2018a) and other countries such as Mainland China, Hong Kong, South Korea, and other East Asian nations (Silver, Hu, & Iino, 2002; Shin et al., 2018). Both government support for a shift

in instructional strategies and pre-service teacher education that adequately prepares teachers to address these instructional needs are necessary.

Modelling results across all three subjects pointed toward to the importance of adaptive motivations-beliefs for achievement during first year at secondary school. Hence, the motivations-beliefs students bring with them from primary school are by implication critical. The final year of primary school has the potential to support students across their first year in this new environment, by ensuring that students enter secondary school studying for adaptive reasons and the appropriate confidence in their abilities to succeed. Given the particularly strong relationships presented for foreign language studies during this first year and potential for self-efficacy transfer between foreign and native language self-efficacy (Fryer & Oga-Baldwin, 2017), foreign language motivations and beliefs might be an area of particular importance.

Limitations and Future directions

The current study failed to support a direct reciprocal model between intrinsic motivation and self-efficacy. Given that recent studies have presented evidence of a reciprocal relationship between interest and self-efficacy at university (Fryer & Ainley, 2019), future studies in the same area of education might test whether this was due to the age of the participants or due to the fact that intrinsic motivation was used, rather than interest specifically.

The present study makes a clear case for assessing students' motivation, self-efficacy, experiences of instruction and achievement together in multiple subject settings. This is only possible through a cross-theoretical approach and rigorous large-scale designs. Cross-theoretical future studies that might contribute to clarifying the important

and at times confusing connections between these essential components of the student experience are therefore called for.

Given the aims and complexity of the current multiple school-subject study, there was insufficient scope to fully discuss the subject specific sex-related differences in motivation, instructional experiences and achievement observed. As a part of the current research programme the specific role of sex will be examined in a follow-up study currently in preparation. Also in preparation, and utilising the full three-year data set, longitudinal modelling using both person-centred (Latent Transition Analysis) and variable-centred (Latent Growth Analysis) will be undertaken to properly examine the development of students' motivations and beliefs for learning across the first three years of secondary school and the implications for instruction.

Educational psychology research with the theories employed in the current study is still at a nascent stage in Japan and in the broader Pacific Asia region. The preliminary studies the current research built upon indicated strong measurement properties and inter-relationships consistent with theorising and empirical research in the West. The present study supported these past findings broadly (e.g., Mathew Effects for motivated, confident students and robust connections between adaptive motivations-beliefs and achievement), but also pointed to how the culture of the Japanese classroom and its culturally specific features (e.g., high curricular expectations, focus on entrance tests, value for drill-and-practice) might be amplfying latent connections less common (perhaps unseen) in Western classrooms. For example, Japan, along with other Confucian Heritage systems of education (i.e., Mainland China, Korea, Taiwan, Hong Kong, and Vietnam), have a strong emphasis on practice, both at school and for homework. This focus on

practice (repetition as a path to mastery), when the instructor is directing it, might explain the unusual connections from externally controlling teaching to students' self-efficacy beliefs. We suggest that further research in classrooms like those participating in the current study has the potential to stress test educational psychology theories that were developed and have been primarily tested in European and North American settings. Just as educators in contexts such as Pacific-Asia can learn much from well-established theory and empirical research from the West, we suggest that these theories might also have much to learn from learning environments like those examined in the current study.

Conclusions

Across each of the three subjects examined, the pairing of intrinsic motivation and self-efficacy beliefs for learning were important predictors of student learning. These findings highlighted the importance of the motivations and beliefs students come to secondary school with and the potential role teachers have in supporting them.

The reciprocal relationships between students' experiences of autonomy-supportive and well-structured instruction and their motivations-beliefs were generally consistent across the three school subjects researched. In contrast, and not hypothesised, interconnections between externally controlling instruction and self-efficacy were varied, and for foreign language classes were reciprocal. These interconnections remind us of the important reciprocal linkages that exist between teachers and students, and the mixed effects this back and forth exchange might have across a year of schooling.

Teacher are often so busy with a wide range of responsibilities across students' first three years of secondary school that it is easy to forgive them for failing to focus on students' motivations and beliefs for learning. It is important to help teachers understand,

however, how they might enhance their support for important elements of the student experience and specifically help those students with less intrinsic motivations and self-efficacy beliefs for learning. The first step in beginning to address this issue might be raising teacher awareness of the importance of these motivations-beliefs and teachers' tendency to provide more support/structure to those that might need it less. The present study suggests that some relatively small, consistent changes to the general amount (and location) of the autonomy-support and structure teachers give students could have meaningful payoffs for student learning across students' critical first year at secondary school.

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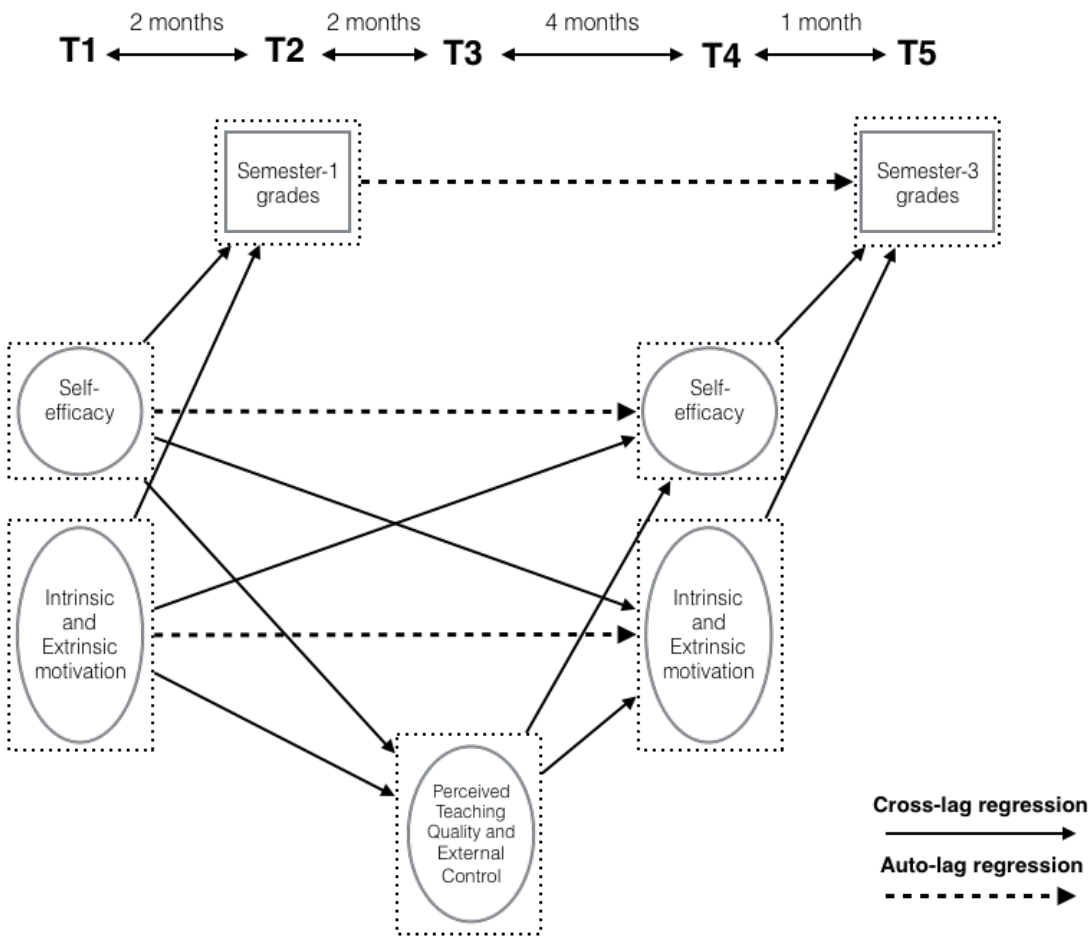

Figure 1. Proposed model for test across foreign language, native language and mathematics subjects.
note: T1 = Time 1, T2 = Time 2, T3 =Time 3, T4 = Time 4, T5 =Time 5

Table 1. Means, Standard Deviations, Confidence Intervals, and Raykov's Rho for all modelled variables.

	ESef T1	ESef T4	EInt T1	EEx T1	EInt T4	EEx T4	ETeach	ECon	EAch1	EAch3
Mean	3.78	3.66	3.65	3.13	3.44	3.13	3.92	2.34	3.38	3.30
Std Dev	1.17	1.17	1.42	1.21	1.37	1.21	1.02	1.11	.99	.97
95% CI	[3.69, 3.89]	[3.57, 3.75]	[3.54, 3.76]	[3.04, 3.22]	[3.34, 3.54]	[3.04, 3.22]	[3.92, 3.99]	[2.26, 2.42]	[3.31, 3.46]	[3.23, 3.37]
Raykov's	.90	.92	.92	.69	.93	.80	.88	.78		
	MSef T1	**MSef T4**	**Min T1**	**Mex T1**	**Mint T4**	**Mex T4**	**MTeach**	**MCon**	**MAch1**	**MAch3**
Mean	3.89	3.64	3.58	3.09	3.32	2.95	4.04	2.33	3.52	3.21
Std Dev	1.28	1.23	1.45	1.28	1.39	1.11	1.06	1.13	.91	.92
95% CI	[3.79, 3.99]	[3.75, 3.93]	[3.47, 3.69]	[2.99, 3.19]	[3.21, 3.43]	[2.87, 3.03]	[3.97, 4.11]	[2.24, 2.42]	[3.45, 3.59]	[3.14, 3.28]
Raykov's	.93	.94	.93	.77	.93	.84	.90	.82		
	JSef T1	**JSef T2**	**JInt T1**	**JEx T1**	**JInt T4**	**JEx T4**	**JTeach**	**JCon**	**JAch1**	**JAch3**
Mean	3.79	3.67	3.46	3.00	3.38	3.09	4.08	2.17	3.37	3.29
Std Dev	1.25	1.19	1.37	1.32	1.34	1.35	1.11	1.14	.86	.90
95% CI	[3.70, 3.89]	[3.58, 3.76]	[3.36, 3.56]	[2.90, 3.10]	[3.28, 3.48]	[2.99, 3.19]	[4.00, 4.08]	[3.79, 3.97]	[2.08, 2.26]	[3.31, 3.46]
Raykov's	.94	.94	.92	.79	.93	.86	.92	.83		

note: E = English, J = Japanese, M = Mathematics, Sef = Self-efficacy, Int = intrinsic, Ex = extrinsic, Teach = structured & supportive teaching, Con = Control, Ach = Achievement, T1 = Time 1, T4 = Time 4

Table 2. CFA and SEM fit for each subject

	E Invar	J Invar	M Invar	E Configural	J Configural	M Configural	E sem	J sem	M sem
RMSEA	.035 (CI 90%: .032–.038)	.038 (CI 90%: .034– .041)	.032 (CI90%: .029–.035)	.035 (CI 90%: .032–.038)	.038 (CI 90%: .035–.041)	.032 (CI 90%: .029– .036)	.038 (CI 90%: .034-.041)	.038 (CI 90%: .032-.040)	.033(CI 90%: .029-.037)
CFI	.956	.957	.967	.956	.956	0.967	.956	.956	.97
TLI	.948	.949	.961	.947	.948	.960	.948	.958	.964
Chi square	1141.596 (630)	1225.220(629)	1064.516(631)	1135.249(620)	1222.008 (619)	1058.333(621)	897.23(561)	868.354(472)	810.229(474)
SRMR	.048	.039	.041	.047	.039	.041	.070	.040	.060

note: E = English, J = Japanese, M = Math, invar = invariance, sem = structural equation modelling

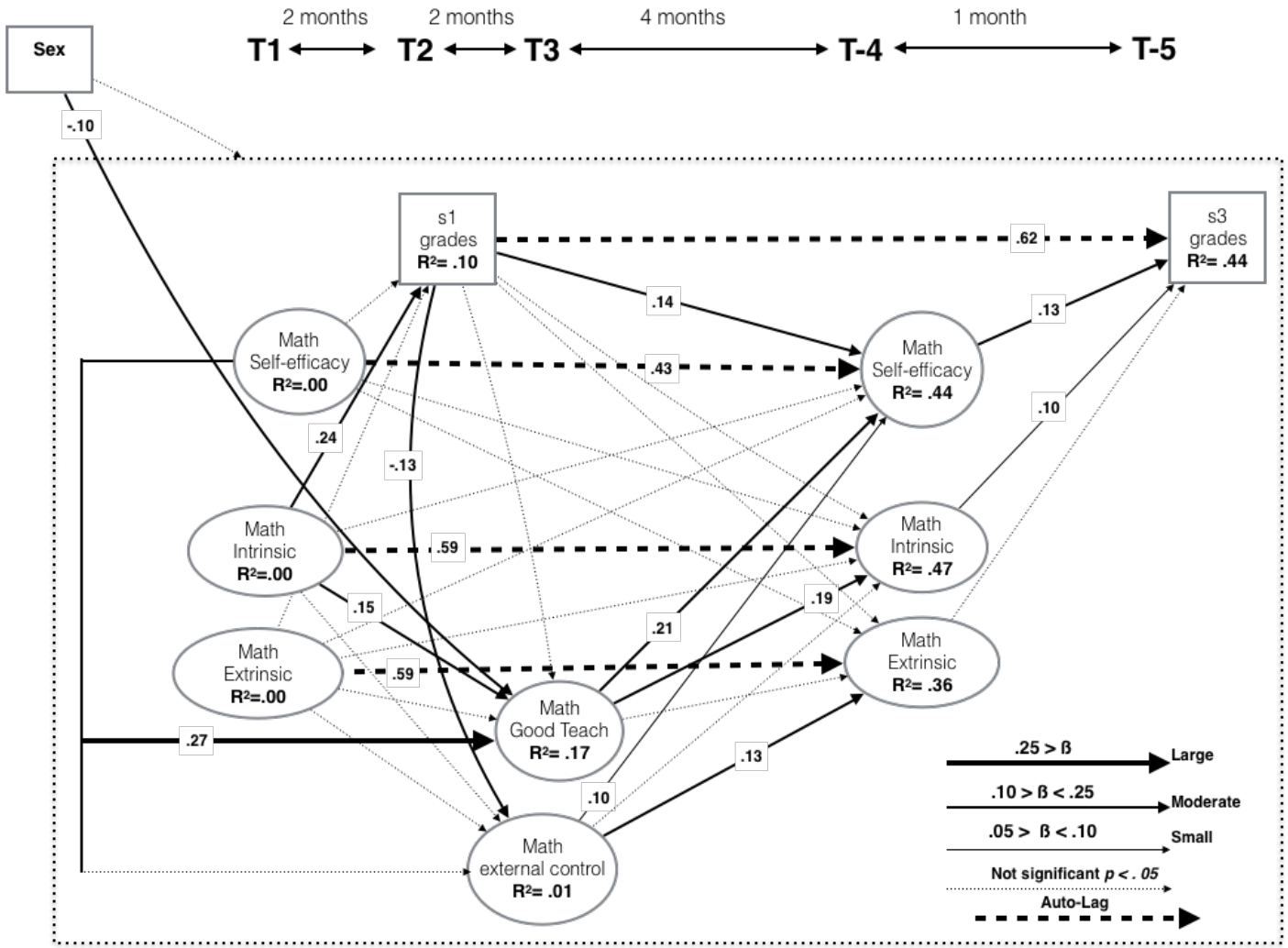

Figure 2. Mathematics cross-lagged model

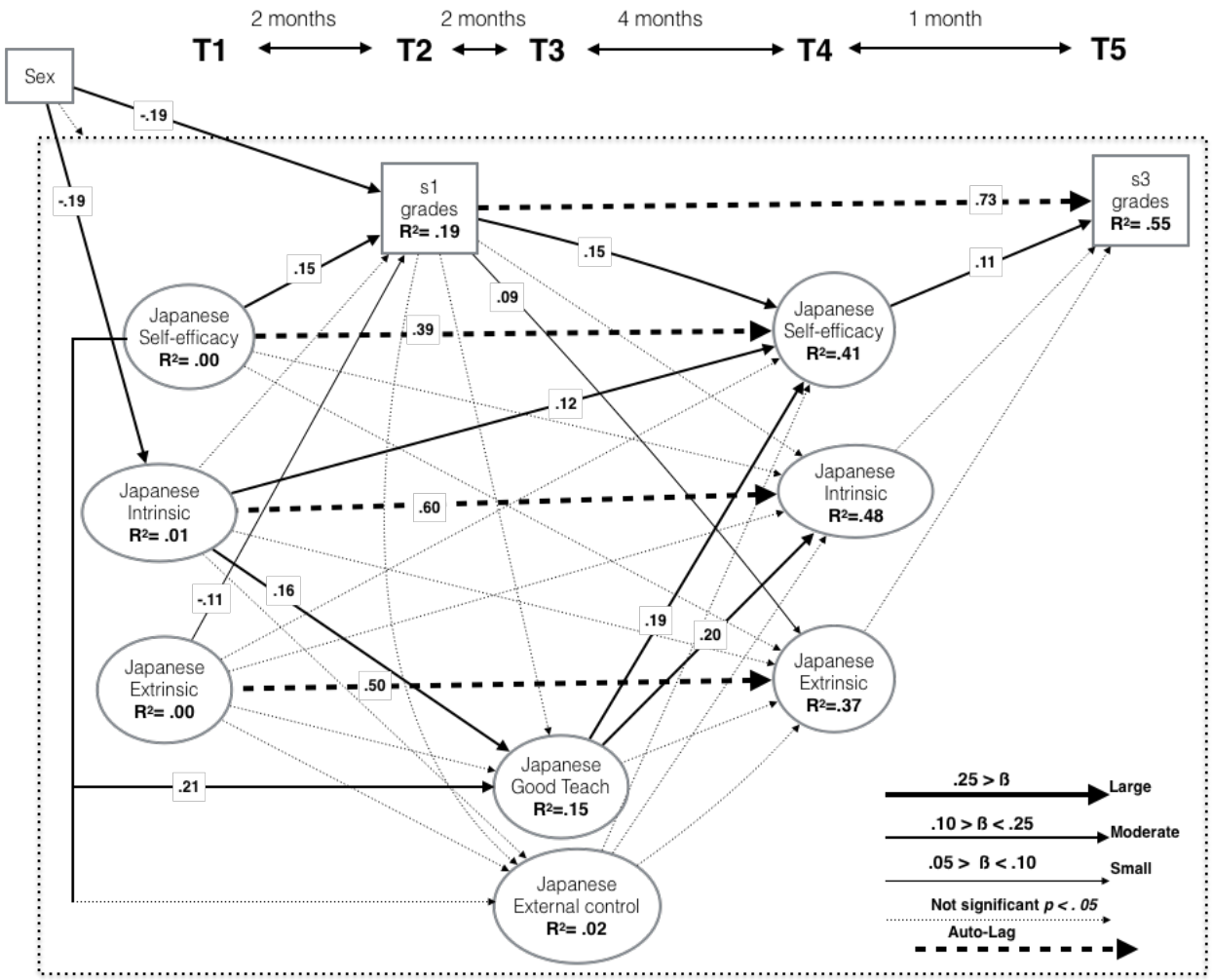
2 months
2 months
4 months
1 month
T1
T2
T3
T4
T5
Sex
-.19
-.19
s1 grades R²= .19
s3 grades R²= .55
.73
.15
.15
.11
.09
Japanese Self-efficacy R²= .00
.39
Japanese Self-efficacy R²=.41
.12
Japanese Intrinsic R²= .01
.60
Japanese Intrinsic R²=.48
-.11
.16
.19
.20
Japanese Extrinsic R²= .00
.50
Japanese Extrinsic R²=.37
.21
Japanese Good Teach R²=.15
Japanese External control R²= .02
.25 > ß
Large
.10 > ß < .25
Moderate
.05 > ß < .10
Small
Not significant p < . 05
Auto-Lag

Figure 3. Native language cross-lagged mode

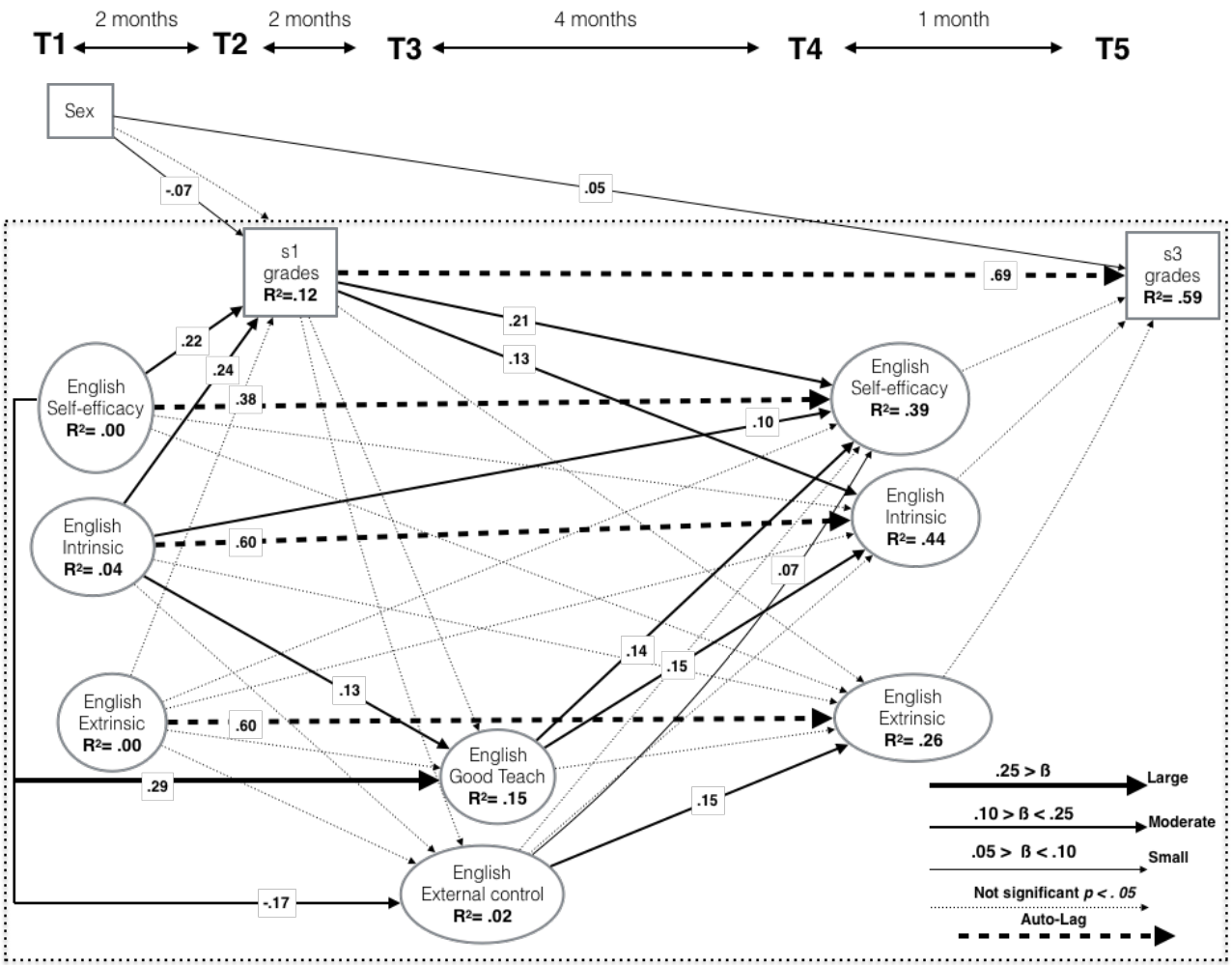

Figure 4. Foreign language (English) cross-lagged model

Appendices

Table 3.

Foreign Language Correlation, Mean, SD and Reliability.

	S1 achieve	S3 achieve	Intrinsic T1	Extrinsic T1	Self efficacy T1	Teach T2	External Control T2	Intrinsic T3	Extrinsic T3
S1 achievement (T2)									
S3 achievement (T5)	.72**								
Intrinsic T1	.41**	.30**							
Extrinsic T1	-.18**	-.19**	-.38**						
Self efficacy T1	.40**	.30**	.71**	-.28**					
Teach T3	.16**	.11*	.34**	-.13*	.38**				
External Control T3	-.08	-.05	-.02	.03	-.11	-.12*			
Intrinsic T4	.37**	.35**	.66**	-.35**	.48**	.35**	.01		
Extrinsic T4	-.09	.07	-.25**	.60**	-.18**	-.08	.17**	-.33**	
Self-efficacy T4	.41**	.37**	.49**	-.21**	.59**	.35**	0	.67**	-.15

note: * = < .05, ** = < .01

Table 4.

Native Language Correlation, Mean, SD and Reliability.

	S1 achieve	S3 achieve	Intrinsic T1	Extrinsic T1	Self efficacy T1	*Teach T2*	External Control T2	Intrinsic T3	Extrinsic T3
S1 achievement (T2)									
S3 achievement (T5)	.77**								
Intrinsic T1	.21**	.26**							
Extrinsic T1	-.11**	-.14**	-.10						
Self efficacy T1	.26**	.24**	.65**	-.05					
Teach T3	.14*	.18**	.32**	-.06	.34**				
External Control T3	-.05	-.07	-.03	0.10	.02	-.07			
Intrinsic T4	.25**	.25**	.65**	-.07	.41**	.37**	-.02		
Extrinsic T4	.00	.00	-.13**	.50**	-.05	-.07	.10	-.10	
Self-efficacy T4	.33**	.31**	.46**	-.02	.57	.39**	-.04	.70**	.02

note: * ≤ .05, ** ≤ .01

Table 5.

Mathematics Correlations, Means, SDs and Reliability

	S1 achieve	S3 achieve	Intrinsic T1	Extrinsic T1	Self efficacy T1	Teach T2	External Control T2	Intrinsic T3	Extrinsic T3
S1 achievement (T2)									
S3 achievement (T5)	.67*								
Intrinsic T1	.32**	.33**							
Extrinsic T1	-.14**	-.14**	-.25**						
Self efficacy T1	.28**	.31**	.73**	-.14*					
Teach T3	.13**	.18**	.35**	-.15*	.38**				
External Control T3	-.18**	-.15**	-.16**	.08	-.12*	-.21**			
Intrinsic T4	.21**	.32**	.65**	-.25**	.50**	.50**	.39**		
Extrinsic T4	-.07	-.05	-.20*	.58**	-.06	-.08	.16**	-.22**	
Self-efficacy T4	.32**	.39**	.51**	-.15*	.61**	.41**	-.11**	.71**	-.06

note: * ≤ .05, ** ≤ .01

Table 6

Items and Confirmatory Factor Analyses

Factor	Item wording	Factor loading (highest and lowest for each item)
Intrinsic 1	Math/English/Japanese is fun	.85 – .87
Intrinsic 2	I'm interested in Math/English/Japanese	.88 – .91
Intrinsic 3	I like learning English	.88 – .92
Extrinsic 1	If I don't participate my teacher will get angry	.64 – .72
Extrinsic 2	Participating is one of the rules	.50 – .78
Extrinsic 3	I have no other choice	.69 – .87
Autonomy Support 1	My teacher understands me	.70 – .75
Autonomy Support 2	My teacher listens to how I would do things	.75 – .86
Autonomy Support 3	My teacher tries to understand how I see things before suggesting a new idea	.76 – .86
Structure 1	If I can't solve a problem, my teacher shows me different ways to try to.	.74 – .82
Structure 2	My teacher shows me how to solve problems for myself.	.83 – .91
Structure 3	My teacher reviews previous material at the start of class.	.61 – .70
Control 1	My teacher uses forceful language	.73 – .81
Control 2	My teacher tries to control everything I do	.67 – .74
Control 3	My teacher puts a lot of pressure on me	.71 – .76
Self-efficacy 1	I'm certain I can master the skills taught in class this year.	.78 – .86
Self-efficacy 2	I'm certain I can figure out how to do the most difficult class work.	.87 – .90

Self-efficacy 3	Even if the work is hard, I can learn it.	.87 – .91
Self-efficacy 4	I can do even the hardest work in this class if I try.	.74 – .84
Self-efficacy 5	I can do almost all the work in this class if I don't give up.	.69 – .83