Abstract

Students' active regulation of learning, through being motivated and a variety of cognitive and metacognitive strategies, is crucial to their online learning success. Despite the large numbers enrolled in online language courses, very little is known about students' motivation and strategy use in these learning environments, or how they may affect their online learning outcomes. This study helps fill this gap by examining students' motivation and learning-strategy use across a number of online language courses, and investigating the role of motivation and such strategies within the framework of self-regulated learning. Based on data about online language-learning strategies collected from 466 high-school-level online language students in a Midwestern virtual school, our findings indicated that online learning strategies operated at a moderate level in the process of foreign language-learning. Further analysis using structural equation modeling revealed that the use of online learning strategies predicted students' online learning outcomes.

Keywords: online learning, language learning, self-regulated learning, learning strategies, motivation, virtual school

1. Introduction

During the 2009-10 academic year, there were more than 1.8 million enrollments in K-12 distance-education courses in the United States (Queen & Lewis, 2011), more than triple the 506,950 enrollments in 2004-05 (Zandberg & Lewis, 2008). The most recent data from the National Center for Educational Statistics were still unavailable at the time of writing, but based on multiple sources of data, Watson, Pape, Murin, Gemin, and Vashaw (2015) estimated that 2.2 million students were taking online courses in 2014-15, a number equating to about 3.8 million course enrollments.

Among all subjects, foreign languages are especially challenging to learn online. A meta-analysis by Cavanaugh (2001) found that, among all K-12 online subject areas, only online foreign-language courses produced negative learning effects. Given that Cavanaugh's study was conducted more than 15 years ago, and dramatic changes in K-12 online learning have taken place over the past few years, its findings could well be obsolete. A more recent study by Oliver, Kellogg, and Patel (2012), however, prompted further concern: reporting that students enrolled in online foreign-language courses at North Carolina Virtual Public School had significantly less positive perceptions of their courses than students taking other subjects had of theirs. Among intermediate and advanced foreign-language students in the same study, just 19% perceived that they learned as much in online courses as in offline ones. Yet, the extent to which Oliver et al.'s participants learned their target languages in online vs. offline courses remained unclear. Nevertheless, the challenges that students perceive in regard to online language courses seem to be unique to K-12 settings, as researchers on the same topic found that beginning and intermediate online language courses in higher education were at least as

effective as their offline counterparts (see Author, 2015 for a review). However, no recent study of K-12 online learning has examined what factors contribute to this challenge.

It is clear from such findings that an examination of the factors affecting student success in online language courses is long overdue. One prominent challenge of K-12 online learning is how to help students learn autonomously, persistently and actively (Lawanto, Santoso, Goodridge, & Lawanto, 2014). This is related to the consensus that successful online learning at any level requires a relatively high degree of autonomy, including self-directed learning practices and the ability to manage one's own time and learning pace. A higher locus of control has been found to result in better online-course performance (Barnard, Lan, To, Paton, & Lai, 2009), and a research synthesis by Barbour and Reeves (2009) indicated that students with high motivation and good self-regulation skills were more likely to succeed in virtual schools.

The cardinal purpose of the present study is to examine this claim by Barbour and Reeves (2009) in the particular context of online language courses offered by a virtual school, and specifically, how motivation and learners' self-directed behaviors affect their learning. Given the special challenges of online language learning (see Cavanaugh, 2001; Oliver et al., 2012), it is critically important to explore how and why motivation and self-regulation may work together in online language courses. Drawing on the self-regulated learning (SRL) framework originated by Zimmerman (2002), we examined the effect on learning outcomes of two main factors: motivation and learning strategies. The following literature review sections review each of them in turn, beginning with the motivational process, and then proceeding to the various specific learning approaches students adopt in order to achieve their learning goals.

2. Self-regulation in Language Learning

SRL refers to "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and contextual features of the environment" (Pintrich, 2000, p. 435). As such, SRL has been recognized as an essential part of learning (Schunk & Zimmerman, 2012; Zimmerman, 2008). In a meta-analysis by Hattie (2008), motivation had an effect size of .48 on student learning outcomes, while cognitive and meta-cognitive strategies had effect sizes of .60 and .53, respectively.

In addition to the beneficial effects of self-regulatory behaviors on students' learning outcomes in traditional classrooms (Pintrich & De Groot, 1990; Zimmerman, 2008), several recent studies have shown that SRL is a crucial factor in students' success in online courses, both in higher education (Barnard et al., 2009) and K-12 settings (Kim, Park, & Cozart, 2014).

It has been argued that SRL is domain-specific, i.e., that a person able to self-regulate in one subject may not be capable of doing so in another (Boekaerts, 1997). The review below therefore identifies two major strands of language-learning-specific SRL research. The first aims to understand the motivational process, and the second, the various learning approaches students adopt in pursuit of their learning goals.

2.1. Language-learning Motivation

Language-learning motivation, according to Dörnyei (1996), poses a unique challenge to general theories of motivation. More so than other subjects, languages involve both personal and social aspects. Learning a language is both a personal matter that reflects one's identity and ethnolinguistic attitudes (e.g., attitudes towards the target

language and its community), and a means of accessing social and cultural resources in target-language communities. Social factors such as perceptions of the status or power of a particular language can affect individuals' willingness to learn it.

This complex combination of cognitive and social aspects has given rise to several competing theories of language-learning motivation. Gardner's (2006) widely popular social-educational model defines language-learning motivation as comprising learners' attitudes towards the languages being studied as well as their drive to learn them. From a cognitive perspective, Noel et al. (2000) introduced Deci and Ryan's (1985) self-determination theory into the field of language learning, and used it to arrive at the concept of motivational orientation: broadly defined as a person's reasons for learning a new language. Given our focus on cognition, we chose self-determination theory as the guiding theoretical perspective for our analysis of motivation.

Application of self-determination theory to language-learning research has distinguished two types of motivation: intrinsic and extrinsic (Deci & Ryan, 1985, 1995). The former refers to doing something because it is inherently satisfying, while the latter refers to doing something to attain external rewards or other positive outcomes. Extrinsic motivation can be further categorized as identified, introjected, or external regulation, based on the level of autonomy manifested: from high (identified) to low (external). Identified regulation refers to the moment when an individual values his/her behavior and accepts the regulatory process: for example, when a language learner realizes that learning a language is good for her. In introjected regulation, in contrast, learners behave in a particular way without fully accepting the value of doing so, to avoid feeling guilty or to maintain their self-esteem: e.g., studying a language because feelings of guilt would

attach to not knowing it, or to knowing only one language. And in external regulation, the least autonomous behavior in this category, behavior is governed by external pressures, expectations, or rewards: for instance, learning a language to get a better job.

The role of intrinsic motivation in L2 learning has long been acknowledged (Noels, Clément, & Pelletier, 1999, 2001; Noels, Pelletier, & Vallerand, 2000), while extrinsic motivation is not necessarily harmful to learning, nor incompatible with intrinsic motivation (Gonzales, 2011; Lin, McKeachie, & Kim, 2001; Mezei, 2008; Wang, 2008). For example, Gonzales reported that Filipino L2 learners' motivation was a combination of intrinsic and extrinsic factors, while Wang's study of Chinese learners of English as a second language reported that extrinsic motivation was positively correlated with intrinsic motivation as well as with learning performance. However, neither of these studies differentiated among the effects of the subtypes of extrinsic motivation.

2.2. Learning Strategies in Language Learning and Online Learning

Several studies have pointed to learning strategies' positive impacts in traditional language-learning courses (for a review, see Ehrman, Leaver, & Oxford, 2003), including overall language proficiency (Seker, 2016) and vocabulary acquisition (Tseng & Schmitt, 2008; Zhang, Lin, Zhang, & Choi, 2016), and to the existence of a positive relationship between L2 achievement and the use of active SRL (Mezei, 2008). High-level L2 learners also appear to be more aware than low-level ones of the process of their own learning, and to have the ability to regulate their learning processes (Khatib, 2010; Mezei, 2008; Tsuda & Nakata, 2013).

Looking beyond traditional language courses, several recent articles have shown that SRL can have positive impacts in technology-enhanced learning contexts, including

digital reading-annotation systems (Chen, Wang, & Chen, 2014), mobile learning environments (Zheng, Li, & Chen, 2016), and online collaborative learning (Kuo, Chu, & Huang, 2015). However, the particular strategies these studies examined, including cognitive strategies (e.g., goal-setting) and metacognitive strategies (e.g., time management and help-seeking), were all domain-general.

Research into online learning has also tended to focus on domain-general strategies, and to report that students' use of SRL strategies is critical to their achieving success (Barnard, Paton, & Lan, 2008; Barnard, William, Crooks, & Paton, 2008; Barnard-Brak, Lan, & Paton, 2010; Kuo, Walker, Schroder, & Belland, 2014; Lee, 2006; Puzziferro, 2008). Compared with face-to-face classrooms, online learning requires students to exercise more autonomous control over their learning behavior (Barnard et al., 2009), and the format of online learning has been found to increase students' motivation, which in turn significantly predicts their achievement (Shih, Gamon, & Emeritus, 2001).

SRL strategies have also been examined. King, Harner, and Brown (2000) measured students' self-regulatory skills in online learning and generalized two factors relating to their use of strategies: study skills and goal-setting. Barnard et al.'s (2009) focus on the need to measure SRL within online environments led to the development of the Online Self-regulated Learning Questionnaire (OSLQ).

Together with students' academic progress, their satisfaction is believed to be critical to evaluation of their online-learning success (Delon & McLean, 1992; Kuo et al., 2014). On the one hand, a high level of online-learning satisfaction is a reflection of students' achievement performance and persistence (Palmer & Holt, 2009); on the other, learners' satisfaction is an important factor in assessing the success and effectiveness of

online-learning program implementation (Delon & McLean, 1992). Previous studies have demonstrated that online-learning satisfaction positively and significantly correlates with students' use of SRL strategies (Kuo et al., 2014; Puzziferro, 2008).

2.3. The Mediating Role of Strategy Use

From the perspective of self-regulation theory, learners generate motivations to initiate and maintain learning, and then apply cognitive and metacognitive strategies to regulate their learning processes (Schunk & Zimmerman, 2012; Zimmerman, 2008). In other words, motivational factors are treated as prerequisites for SRL (Ryan & Deci, 2000), and students who are more motivated to learn regulate their learning more actively, using a variety of strategies (Pintrich & De Groot, 1990).

For a variety of subjects including reading, law, and psychology (among others), learning strategies have been empirically shown to play a mediating role in the relationship between motivation and learning performance (Khatib, 2010; Law, 2009; Logan, Medford, & Hughes, 2011; Walker, Greene, & Mansell, 2006). Specifically, this body of work supports the existence of predictive relationships between 1) motivational constructs and the use of learning strategies, and 2) learning strategies and learning performance. For example, Law found that students with high intrinsic motivation tended to be more aware of strategy-use, and that such awareness predicted their reading performance better than any other examined factor. Logan et al., however, reported only an indirect relationship between motivation and achievement (via the use of cognitive strategies), and that motivation did not explain any of the extra variance in the prediction of performance.

Although learning strategies have been found to mediate the relation between motivation and academic achievement in many domains, few empirical studies have specifically addressed this issue in either L2-learning or online-learning contexts. Those that have done so largely concur that there is a positive relationship among motivation, learning-strategy use, and learning achievement; that highly motivated students are more likely to use various learning strategies in L2 learning; and that a higher level of strategy use correlates with higher learning achievement. To date, however, most studies dealing with motivation and strategic learning in L2 education have focused on either the first part of the model – the relationship between motivation and learning-strategy use (Vandergrift, 2005; Wharton, 2000) – or the second part, i.e., how learning-strategy use predicts L2 achievement (Barcroft, 2009; Lai, 2009; Mezei, 2008).

Kormos and Csizér (2013) examined the mediation effect of learning strategies in L2 SRL contexts using structural equation modeling (SEM), and found that strong motivation was a prerequisite for the adoption of SRL strategies, which in turn predicted students' autonomous learning. Similarly, Ayatollahi, Rasekh, and Tavakoli (2012) found that SRL techniques – especially metacognitive strategies and resource-management strategies on cognitive strategies – mediated the relationship between L2 learners' beliefs about learning and their achievement. Zhang et al. (2016) further examined how learning strategies mediate the effect of motivation on learning outcomes among high-school L2 learners, and found that learning strategies partially mediated the relationship between intrinsic motivation and vocabulary knowledge, and fully mediated the relationship between extrinsic motivation and vocabulary knowledge. We should interpret these findings with caution, however: Kormos and Csizér examined students' autonomous

learning behavior rather than L2 performance as the outcome variable, while Ayatollahi et al. used students' self-belief rather than motivational variables as prerequisites for SRL.

Some studies have endorsed the importance of SRL strategies to students' autonomous learning in online contexts (Barnard et al., 2008; Puzziferro, 2008), but little research has explicitly investigated the role of learning-strategy use in online settings. One of the rare examples was Barnard, Lan, Crooks, and Paton's (2008) study of 434 students enrolled in an online course, which found that SRL skills positively mediated the relationship between learning beliefs and final course grades. Another found that SRL strategies mediated the positive relationship between students' perceptions of learning and their academic achievement (Barnard et al., 2008).

Accordingly, our research questions are as follows:

1. How do different types of motivation predict students' learning outcomes?
2. How do learning strategies predict students' learning outcomes?
3. How do motivation and learning strategies jointly predict students' learning outcomes?

3. Methods

This study was conducted in a virtual school in the Midwestern U.S. in the spring of 2014. Though termed a school, this was in fact a non-profit, state-wide supplemental program (authorized by the state and overseen by state agencies) in which students took individual courses, while also being enrolled in a physical school or cyber-school within the same state. This means that students still went to their local schools on a regular basis, and enrolled in online courses in this virtual school at the same time. In their virtual-school courses, students learned in a self-paced manner, and all course-related

communication took place asynchronously, mostly via messages and online discussion boards. Most students went to computer labs or other designated sites in their local schools for a particular number of hours to study for their online courses, while some who received seat-time waivers (see Rice et al., 2014) were allowed to study at home or other places outside of school.

The learning materials used in the virtual school's language courses were off-the-shelf online learning materials licensed from third-party vendors, though all were vetted by the school for their compliance with its quality standards. Assessment in these online language courses was via a combination of computer-graded questions and instructor-graded writing.

3.1. Participants

During the spring semester of 2014, we sent invitations to participate in this research to a total of 1,593 students, via their instructors. All of these potential participants were enrolled in high-school level online courses in Chinese, French, German, Japanese, Spanish, or Latin. The great majority of those contacted were of normal high-school age, though some were middle-schoolers attending the virtual school as a result of petitions to do so that had been approved by their own schools.

Our student survey consisted of 67 items (described in more detail below), all of which were adapted from previous studies that had found them to have good reliability. These items were also evaluated by three experts in K-12 online learning and two senior people from the school to ensure they were appropriate for the current project. The survey was hosted on Qualtrics and took approximately 20-25 minutes to complete. The participants were asked to report their demographic information, motivations, learning

strategies, satisfaction with online learning, and perceived learning progress. We received 466 completed surveys. This response rate, 29%, was very close to another study conducted in virtual schools (Borup, Graham, & Davies, 2013).

3.2. Measures

All survey items were responded to using a seven-point Likert-scale, ranging from 1 = “not at all true of me”, to 7 = “very true of me”.

3.2.1. Demographic information

The participants were asked to report their age, gender, ethnicity, and grade level.

3.2.2. Motivation

Two types of motivation, intrinsic and extrinsic, were measured using an instrument adopted from Noel et al. (2000).

3.2.3. Intrinsic motivation

Intrinsic motivation was measured via three sub-constructs: knowledge (three items, $\alpha = .83$, e.g., *I study the target language for the good feeling I get from finding out new things*), accomplishment (three items, $\alpha = .91$, e.g., *I study the target language for the enjoyment I experience when I understand a difficult idea in the target language*), and stimulation (three items, $\alpha = .88$, e.g., *I study the target language for the good feeling I get when I speak the target language*).

3.2.4. Extrinsic motivation

We also adopted three subsets of extrinsic motivation in language learning from Noel et al. (2000): identified regulation, introjected regulation, and external regulation. Identified regulation was measured using three items ($\alpha = .86$, e.g., *I study the target language because I want to be the kind of person who can speak more than one*

language); introjected regulation with another three (α = .74, e.g., *I study the target language because I would feel guilty if I didn't know a second language*); and external regulation with an additional three (α = .69, e.g., *I study the target language in order to have a better salary later*).

3.2.5. Online-learning strategies

Our measurements of students' use of online-learning strategies were adopted from the OSLQ (Barnard-Brak et al., 2010), and included goal-setting (four items), task strategies (four items), help-seeking (three items), and self-evaluation (three items). For the purposes of this study, several items were rephrased so as to be more appropriate to the comprehension level of typical high-school students. Following such changes, the factor structure and reliability of online-learning strategies were reevaluated using exploratory factor analysis (EFA) (principal factor in Stata). The number of factors retained was decided based on Kaiser's eigenvalue rule (Hayton, Allen, & Scarpello, 2004) and the examination of a scree plot. The factor loadings, uniqueness of each item, and Cronbach's alphas of these two factors are presented in Table 1.

The results suggested a two-factor solution, which explained 76% of the variance after an oblique rotation (varimax). The first factor, with an eigenvalue of 4.98, contained 10 items with a high internal reliability, .88. One sample item from this group was, *I keep a high standard for my learning in my online courses*. We named Factor 1 *metacognition*.

The second factor, with an eigenvalue of 1.43, contained only two items. One of them was, *I communicate with my classmates to find out how I am doing in my online classes*. These strategies also had a high internal reliability, .89. We named Factor 2

communication with peers. However, since Factor 2 was not in the original OSLQ, it was excluded from further analysis.

(Insert Table 1 here)

3.2.6. Satisfaction

Students completed four items assessing their satisfaction with the online course, adapted from Kuo (2010), with $\alpha = .92$. One sample item for measuring satisfaction was, *I am satisfied with this class*.

3.2.7. Perceived progress

We developed three items to assess students' perceived progress in online language learning, $\alpha = .91$. One sample item for measuring perceived progress was, *I understand most of the content in the class*.

3.2.8. Final grades

All participants' final grades were obtained from the school at the end of the semester.

3.3. Data Analysis

Confirmatory factor analysis (CFA) was adopted to test the validity of the latent construct of online-learning strategies. SEM was used to investigate the structural relationships among learning outcomes (i.e., student satisfaction, perceived progress, and final grades), online-learning motivation, and strategy use. Prior literature suggested that self-regulation may have different impacts on different online learning outcomes (e.g., Kuo et al., 2014), so we conducted SEM separately for each outcome variable. Specifically, three structural equation models were created. Model 1 evaluated the effect of self-determination (i.e., intrinsic motivation, identified motivation, introjected

regulation, and external regulation) on satisfaction as mediated by learning strategies (i.e., metacognitive strategies). Model 2 changed the dependent variable to perceived progress, and Model 3 evaluated another dependent variable: students' final grades.

Based on the results of CFA and SEM, researchers can decide whether the hypothesized model is supported by the sample data (Schumacker & Lomax, 2010). Three statistical indices about the degree of fitness of the model are reported: the chi-square goodness-of-fit (χ^2), the Root Mean Square Error of Approximation (RMSEA), and the Comparative Fit Index (CFI). A non-significant chi-square value indicates that the model is a good fit. However, since the chi-square test is sensitive to sample size, and a large sample size can easily lead to a significant chi-square result, RMSEA and CFI should be used to confirm the fitness of the model (Schumacker & Lomax, 2010). A CFI larger than .9 is considered to indicate an adequate model fit, and larger than .95 a good fit; while an RMSEA smaller than .08 reflects an adequate fit, and smaller than .05 a good fit (Hu & Bentler, 1999). All data analyses were performed in Stata 13.

4. Results

4.1. Measurement Model

We performed CFA to measure the fitness of the latent factors of intrinsic motivation (three indicators), identified regulation (three indicators), introjected regulation (three indicators), external regulation (two indicators), learning strategies (10 indicators), satisfaction (four indicators), and perceived progress (three indicators). The results of maximum likelihood estimation indicated that the assumption for the seven latent variables holds, χ^2 (326) = 868.16, $p < .001$, CFI = .94, RMSEA = .06 (see Table 2). Despite the significance of the chi-square result, both CFI and RMSEA were

consistent with the cutoff model-fit criteria recommended by Hu and Bentler (1999), which suggests that our model had a reasonable factor structure. Mean scores for each latent variable were calculated for subsequent analyses.

(Insert Table 2 here)

4.2. Descriptive Statistics

Table 3 shows the mean scores and standard deviations of students' responses to our questionnaire. The participants' satisfaction and perceived progress were moderate (M = 4.47, M = 4.75, respectively). In addition, the students reported moderate levels of intrinsic motivation (knowledge = 4.59, accomplishment = 4.63, stimulation = 4.34) and identified motivation (M = 5.13), but relatively low levels of introjected and external motivation (M = 2.52, M = 3.82, respectively). Metacognitive learning strategies were used moderately (M = 4.29).

(Insert Table 3 here)

4.3. Testing the Hypothesized Models

Table 4 shows the results of Model 1. Neither learning strategies nor satisfaction were predicted by any of the motivational variables (i.e., intrinsic motivation, identified regulation, introjected regulation, and external regulation). Online learning strategy was the only variable that predicted student satisfaction (β = .58, p < .001). In all, Model 1 explained 42.5% of the variance in student satisfaction, as calculated using the Bentler-Raykov squared multiple-correlation coefficient (Bentler & Raykov, 2000).

(Insert Table 4 here)

Table 5 presents the results of Model 2. In parallel to the results from Model 1, the motivational variables all failed to predict either learning strategies or perceived

progress. Online learning strategy was the only variable that predicted students' perceived progress (β = .72, p < .001). Around 55.3% of the variance in students' perceived progress was explained by Model 2.

(Insert Table 5 here)

Table 6 sets forth the results of Model 3. Much as with Models 1 and 2, none of the four motivational variables predicted either learning strategies or final grades. Online learning strategy was the only useful predictor of the participants' perceived progress (β = .42, p < .001). Model 3 explained around 11.9% of the variance in the students' final grades.

(Insert Table 6 here)

5. Discussion

We investigated the relationships among motivation, learning strategies, and learning outcomes in the hope of unveiling why some online language learners succeed, given that language courses are considered the most challenging among all subjects taught online (Cavanaugh, 2001). Based on the three research questions, our research yielded three major findings: 1) that motivational variables (i.e., intrinsic and extrinsic motivation) did not predict online-learning outcomes; 2) that online-learning strategies played an important role in online language learning, insofar as their use positively predicted the respondents' satisfaction, perceived progress, and final grades; and 3) that, because motivation did not predict online-learning outcomes, learning strategies were the only variable that predicted students' learning outcomes.

5.1. Motivation

Our finding that motivational variables (whether intrinsic or extrinsic) did not significantly predict any online learning outcomes stands in contrast to most prior work, regardless of whether such work focused on traditional face-to-face language courses in higher-education settings (Tseng & Schmitt, 2008) or in secondary education (Zhang, Lin, Zhang, & Choi, 2016), or on online learning courses in other higher-education subjects (Kuo et al., 2014). However, Kim et al. (2014) preceded us in reporting the insignificance of the relation between motivation and student achievement, in the case of online secondary-school math courses.

Kim et al. (2014) used self-efficacy and intrinsic value as their motivational variables. When these two variables were regressed on math achievement, only self-efficacy showed a significant coefficient, and explained about 13% of the variance. After "achievement emotion" was added to the model, self-efficacy became insignificant, but the overall variance explained increased to 37%. Kim et al. then added cognitive and metacognitive strategies, neither of which showed a significant association with math achievement. In our view, however, neither Kim et al.'s nor our own findings should be used to challenge the importance of self-determination theory or to discount the importance of motivation in online learning. Rather, these two sets of results should be taken to indicate that the mechanism(s) by which motivation affects online learning in virtual-school settings may be different from the mechanism(s) by which it operates in traditional secondary-level or undergraduate courses. In virtual-school settings, moreover, additional mediating variables may also be present. As Kim et al. suggested, motivation may be intertwined with emotion as well as with learning, but the present study does not have sufficient data to confirm or reject this idea.

Another possible explanation may reside in the specific online-language-learning context of the present study. As indicated by descriptive statistics, our participants' average intrinsic motivation was at a moderate level, and their average extrinsic motivation was even lower. This reflected the fact that in general, neither intrinsic nor extrinsic motivation was at a high level. This closely echoed Jaggers' (2014) finding that students in online language courses exhibited low motivation. In the current study, the asynchronous learning format, the importance of practicing language skills when learning a foreign language, and a lack of active interaction with teachers and fellow students could explain why students felt less motivated to study language in an online setting.

5.2. Online Learning Strategies

The present study has demonstrated that online language learners can be aware of their learning and can make active use of strategies to master new knowledge. Our findings regarding students' online SRL strategies are consistent with those of previous learning-strategy research conducted in offline contexts (e.g., Zimmerman & Pons, 1986), which investigated high-school students' use of SRL strategies such as goal-setting, self-evaluation, organizing, and seeking peer-, teacher-, or adult assistance. As Zimmerman (2008) pointed out, self-regulated learners plan, set goals for, organize, seek helpful resources for, monitor and evaluate their learning at different points during knowledge acquisition. Our study further extends SRL research beyond traditional language-learning contexts and into the domain of online language learning.

Though we found that high-school students adopted learning strategies in their online language courses, the use of such strategies was at a moderate level (i.e., 4.29 out of 7: see Table 3). Nevertheless, the use of such strategies was the only significant

predictor of final grade, perceived progress, or student satisfaction. The moderate level of online learning-strategy use was consistent with findings derived from research on traditional language courses (Seker, 2016; Zhang et al., 2016), and the significance of the impact of learning strategy on language-learning outcomes has consistently been documented in previous studies in both postsecondary (e.g., Anderson, 2012; Tseng & Schmitt, 2008) and secondary contexts (e.g., Zhang et al., 2016). Our study confirms such findings in the case of online secondary-level world-language courses.

5.3 The Mediating Role of Strategy Use

A mediating role of learning strategy on the relation between motivation and language-learning outcomes was previously identified in face-to-face settings (Ayatollahi et al., 2012; Kormos & Csizér, 2013; Zhang et al., 2016). However, the present research did not find that either learning strategies or learning outcomes were predicted by any of the motivational variables we examined (i.e., intrinsic motivation, identified regulation, introjected regulation, or external regulation); and we therefore could not test the mediation effect of learning strategies on learning outcomes in the studied online-learning settings. As discussed in section 5.1 with respect to the use of motivation in online-learning settings, we are not aiming to challenge SRL theory, the predictive power of motivation on learning, or the mediation effect of learning strategies. Rather, we believe that the low levels of motivation exhibited by our participants hindered their use of learning strategies in online learning. Since both the asynchronous format of our study setting and its learning material (i.e., languages) might be associated with low motivation, we recommend that future studies of online learning pay special attention to students' level of motivation, and examine whether it varies across course formats and subjects.

It is also worth touching on the variance explained for each online learning outcome. Online learning strategy explained 42.5% of the variance in student satisfaction, 55.3% in perceived progress, and 11.9% in final grades. The effect size was medium for satisfaction (d = .58), approaching large for perceived progress (d = .72), and approaching medium for final grades (d = .42). Overall, our models explained more variance than Kim et al.'s (2014) emotion-based models did for virtual-school math courses (37%).

Several limitations of the present work should be addressed by future research. First, we adopted Barnard et al.'s (2009) OSLQ, but the factor loadings were not satisfactory and we had to run EFA before further analysis. The results of EFA were mainly loaded on one factor (i.e., metacognitive strategies), with just two items loaded on the second factor. We were thus unable to show which learning strategy had more predictive power vis-à-vis online learning outcomes, despite this being what OSLQ was originally designed to do. Future use of OSLQ in research on high-school level online language courses should be piloted before dissemination. Second, the current study only focused on the high-school online language courses offered by a single virtual school, in which the learning mode was asynchronous and self-paced. Thus, our findings are not likely to be generalizable to other contexts. If we are to arrive at a clear understanding of whether the impact of motivation and learning strategies on learning outcomes is intertwined with learning contexts, broader assessment of the roles of motivation and learning strategies in other online settings (e.g., that differ in their delivery modes, subjects, and/or teaching approaches) will be required. Third, we investigated individual differences in motivation, learning strategies, and learning outcomes only during a single semester. Other individual differences among the participants – such as prior knowledge

– might also have predicted online learning outcomes. A longitudinal study with a larger sample and additional variables would therefore be useful. Last but not least, in addition to quantitative measurement of motivation and learning strategies, qualitative interviews might prove useful in future studies, by providing a more thorough understanding of how motivation and learning strategies may affect learning in K-12 online settings.

6. Conclusions and Implications

The purpose of this study was to examine the roles of motivation and learning strategies, and the mediation effect of learning strategies, in K-12 online learning. Its findings imply that online learning outcomes were not predicted by motivation (either intrinsic or extrinsic); and that using SRL strategies was the only significant predictor of our respondents' online language-learning success. Given that motivation did not predict learning outcomes, learning strategies could not have mediated any effect of motivation on learning outcomes.

This study contributes to the body of research on the role of self-regulation in online learning, and extends it to cover secondary-level online language courses. The results from our structural model are in line with previous findings on self-regulation, which underscored learning-strategy use as a key component in learning (Khatib, 2010; Law, 2009; Logan, Medford, & Hughes, 2011; Pintrich & De Groot, 1990; Walker, Greene, & Mansell, 2006). The effect size of online learning-strategy use on our participants' online-learning outcomes was medium, approaching large. Taken as a whole, our results suggest that increased use of online learning strategy may help to improve student satisfaction, perceived progress, and final grades.

As such, our study has important pedagogical implications for online language instructors. Given the positive effects of the use of online learning strategies on final grades, perceived progress, and student satisfaction, online instructors should equip learners with self-regulation skills. Such skills are especially important for learning foreign languages, as students usually do not receive enough in-class language exposure to ensure their learning success (Tsou, Wang, & Tzeng, 2006). Therefore, developing students as self-regulated learners may help to sustain their language learning long after their formal language courses are completed. In terms of language-learning strategies, Oxford (2011) provided practical tasks for traditional classroom instruction, and Chang (2007) showed that specific instruction on learning strategies can enhance language-learning outcomes in web-based undergraduate English courses. Accordingly, online instructors and course designers should seek effective ways to incorporate instruction about online learning strategies into their online courses.

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Table 1. Exploratory Factor Analysis of Online Learning Strategies

	Factor1	Factor2	Uniqueness
I set short-term (daily or weekly) goals as well as long-term goals (monthly or for the semester).	**0.65**	0.10	0.56
I keep a high standard for my learning in my online courses.	**0.81**	0.07	0.33
I set goals to help me manage studying time for my online courses.	**0.60**	-0.03	0.64
I do not compromise the quality of my work because it is online.	**0.78**	0.08	0.39
I try to take more thorough notes for my online courses because notes are even more important for learning online than in a regular classroom.	**0.59**	0.10	0.64
I read aloud instructional materials posted online to fight against distractions.	0.38	0.28	0.78
I prepare my questions before joining in the chat room and discussion.	**0.53**	0.15	0.69
I work extra problems in my online courses in addition to the assigned ones to master the course content.	**0.58**	0.35	0.54
I summarize my learning in online courses to examine my understanding of what I have learned.	**0.58**	0.33	0.55
I communicate with my classmates to find out how I am doing in my online classes.	0.09	**0.87**	0.23
I ask myself a lot of questions about the course material when studying for an online course. (change order in codes)	**0.72**	0.20	0.44
I find someone who is knowledgeable in course content so that I can consult within him or her when I need help.	0.34	0.38	0.74
I share my problems with my classmates online so we know what we are struggling with and how to solve our problems.	0.07	**0.88**	0.22
I am persistent in getting help from the instructor through e-mail.	**0.46**	0.17	0.76
Cronbach’s alpha	0.88	0.89	

Table 2. Results for the Measurement Model (*N*=466)

Latent variable	Item	Standardized factor loading
Intrinsic motivation		
	knowledge	.89***
	accomplishment	.91***
	stimulation	.89***
Identified regulation		
	identified1	.78***
	identified2	.75***
	identified3	.78***
Introjected regulation		
	introjected1	.54***
	introjected2	.80***
	introjected3	.78***
External regulation		
	external1	.94***
	external2	.82***
Learning strategies		
	strategy1	.62***
	strategy2	.81***
	strategy3	.56***
	strategy4	.76***
	strategy5	.59***
	strategy6	.53***
	strategy7	.64***
	strategy8	.48***
	strategy9	.65***
	strategy10	.76***
Satisfaction		
	satisfaction1	.95***
	satisfaction2	.78***
	satisfaction3	.92***
	satisfaction4	.81***
Perceived progress		
	perceived progress1	.87***
	perceived progress2	.88***
	perceived progress3	.89***

Note: *** $p < .001$. χ^2 (326) = 868.16, $p < .001$, CFI = .94, RMSEA = .06.

Table 3. Descriptive Statistics of Constructs in the Study

Construct	Mean	Standard deviation	Cronbach's alpha
Learning outcome			
Satisfaction	4.47	1.91	0.92
Perceived progress	4.75	1.78	0.91
Final grades	79.28	22.60	--
Intrinsic motivation			
Knowledge	4.59	1.68	0.83
Accomplishment	4.63	1.85	0.91
Stimulation	4.34	1.88	0.88
Identified regulation	5.13	1.60	0.86
Introjected motivation	2.52	1.54	0.74
External regulation	3.82	1.60	0.69
Learning strategies			
Metacognition	4.29	1.31	0.88

Table 4. The Results of Structural Equation Modeling on Satisfaction

	Path	Standardized coefficient	SE
Structural Model	Intrinsic → Learning strategies	.27	.31
	Identified → Learning strategies	.37	.34
	Introjected → Learning strategies	.06	.05
	External → Learning strategies	.04	.08
	Intrinsic → Satisfaction	.34	.29
	Identified → Satisfaction	-.21	.32
	Introjected → Satisfaction	-.06	.05
	External → Satisfaction	-.01	.07
	Learning strategies → Satisfaction	.58***	.06

Note: ***p < 0.001. χ^2 (257) = 626.04, $p < .001$, CFI = .95, RMSEA = .06.

Table 5. The Results of Structural Equation Modeling on Perceived Progress

	Path	Standardized coefficient	SE
Structural Model	Intrinsic → Learning strategies	.24	.31
	Identified → Learning strategies	.39	.34
	Introjected → Learning strategies	.05	.05
	External → Learning strategies	.04	.08
	Intrinsic → Perceived progress	.14	.27
	Identified → Perceived progress	-.10	.30
	Introjected → Perceived progress	-.06	.05
	External → Perceived progress	.04	.06
	Learning strategies → Perceived progress	.72***	.05

Note: ***p < 0.001. χ^2 (234) = 623.72, p < .001, CFI = .94, RMSEA = .05.

Table 6. The Results of Structural Equation Modeling on Final Grades

	Path	Standardized coefficient	SE
Structural Model	Intrinsic → Learning strategies	.24	.20
	Identified → Learning strategies	.39	.26
	Introjected → Learning strategies	.06	.07
	External → Learning strategies	.04	.05
	Intrinsic → Final grades	.11	4.33
	Identified → Final grades	-.24	5.62
	Introjected → Final grades	-.10	1.50
	External → Final grades	.04	0.99
	Learning strategies → Final grades	.42***	1.50

Note: ***p < 0.001. χ^2 (192) = 499.07, p < .001, CFI = .94, RMSEA = .06.