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VALIDATION OF SCORES ON THE ONLINE HOMEWORK EXPECTANCY VALUE COST SCALE: INVARIANCE ACROSS GENDER AND COLLEGE YEAR

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ABSTRACT

We validated the Online Homework Expectancy Value Cost Scale (OHEVCS) involving 1,192 college students. Results indicated that the OHEVCS consisted of three distinct yet related subscales: online homework expectancy, value, and cost. In addition, results indicated no latent mean differences in the OHEVCS over gender (males vs females) and college year (years 1-2 vs years 3-4). Finally, online homework expectancy and value were associated positively with online homework completion and negatively with online homework distraction and procrastination. Online homework cost was associated positively with online homework distraction and procrastination and negatively with online homework completion. Our results strongly support the idea that the OHEVCS is a valid tool for assessing motivational beliefs in online homework.

Keywords: Expectancy-value theory, homework, online assignment, motivation, college students

Introduction

Due to rapid advancements in information technology and the widespread adoption of computers and mobile devices, online learning has become a conventional offering among higher education establishments across the globe (O'Neil et al., 2021; Seaman et al., 2018). Given this shift toward online education, more and more college students are being asked to do their homework online (Padgett et al., 2021; Xu, 2022a). This is particularly true as recent research has found that online homework assignments can enhance students' learning and performance (Brevik, 2020; Dendir, 2023). While online assignment(s) and online homework are frequently used interchangeably (Motz et al., 2021; Yalçın & Şevik, 2020), this distinction becomes less relevant for fully online students (Xu, 2022a): As these students complete all their coursework remotely, their online assignments literally become online homework by default.

Whereas online homework presents new opportunities, such as getting feedback right away, it also introduces novel motivational obstacles relating to the confidence and value of online assignments (Magalhães et al., 2020; Xu, 2022a). It often requires students to use technology and engage in self-directed learning, which can lead to uncertainty about their technical skills and ability to navigate online platforms. This uncertainty may foster anxiety and self-doubt, ultimately discouraging assignment completion. Struggles with the online learning environment and technical issues can further diminish students' confidence in their academic abilities, leading to procrastination and disengagement.

Additionally, the perceived value of online assignments significantly impacts motivation. If students view these tasks as irrelevant to their educational goals or future careers, their motivation to complete them declines. When assignments are perceived as busy work rather than valuable learning opportunities, students are less likely to invest the effort needed for successful completion.

With the growing prevalence of Internet-connected devices, students can work on online homework assignments at nearly any time from virtually any location (e.g., at home or home-like settings; Beckman et al., 2021; Xu et al., 2020). However, this flexibility introduces connectivity-related motivational challenges, including distractions, unstructured study environments, and self-regulation issues. First, devices that facilitate access to online assignments often come with numerous distractions, such as social media and games. This constant availability can hinder focus, decrease motivation, and increase procrastination. Second, while the ability to work from any location can be advantageous, it often leads to a lack of a structured study environment. In traditional classrooms, students benefit from an atmosphere that fosters engagement, whereas home settings may lack this discipline, making it harder for students to stay motivated. Lastly, increased accessibility places greater responsibility on students for self-regulation. Without the guidance of a structured schedule, many struggle with time management, leading to last-minute cramming and ultimately reducing learning outcomes.

The increased flexibility and decreased face-to-face interactions with instructors pose extra motivational challenges (e.g., cyber-slacking, self-motivation and in-person accountability due to the lack of set class times) for students accustomed to traditional paper-based assignments, thereby undermining their drive to complete online homework (Barrot & Fernando, 2023; Dang et al., 2023; Felker & Chen, 2023; Hassan et al., 2021; Koay & Poon, 2023; Lengkanawati et al., 2021; Noor & Isa, 2023; Ryan & Deci, 2000; Sriwichai, 2020; Zhu et al., 2024). This flexibility can lead to cyber-slacking or cyberloafing, where students engage in non-academic

activities during study times (Dang et al., 2023; Felker & Chen, 2023). The absence of structured environments allows for easy distraction, further diminishing motivation to complete assignments (Koay & Poon, 2023).

Self-motivation and accountability also suffer in online formats. Students who thrive on face-to-face interactions often rely on direct engagement with instructors and peers to foster accountability. Without this, they may struggle to find the intrinsic motivation needed for online assignments (Lengkanawati et al., 2021). Research indicates that limited interaction can lead to feelings of isolation, negatively impacting motivation and academic performance (Barrot & Fernando, 2023; Noor & Isa, 2023; Sriwichai, 2020).

Moreover, the lack of set class times disrupts routines, complicating efforts to establish a consistent study schedule (Sriwichai, 2020). Structured routines are vital for maintaining academic motivation and discipline (Hassan et al., 2021; Ryan & Deci, 2000; Zhu et al., 2024). Transitioning from a structured classroom to a flexible online environment can result in procrastination and disengagement (Barrot & Fernando, 2023; Noor & Isa, 2023).

Research Problem Statement

The transition to online homework has introduced significant motivational challenges that can undermine students' completion of these assignments. Research indicates various motivational barriers, including confidence and the perceived value of online tasks (Magalhães et al., 2020; Xu, 2022a). The flexibility of online learning environments often leads to motivational obstacles stemming from Internet connectivity, such as distractions, the absence of structured study settings, and difficulties with self-regulation (Beckman et al., 2021; Xu et al., 2020). Additionally, factors like cyber-slacking, diminished self-motivation, and the lack of in-person accountability due to the absence of fixed class times further exacerbate these challenges (Barrot & Fernando, 2023; Dang et al., 2023; Felker & Chen, 2023; Hassan et al., 2021; Koay & Poon, 2023; Lengkanawati et al., 2021; Noor & Isa, 2023; Ryan & Deci, 2000; Sriwichai, 2020; Zhu et al., 2024). Moreover, the lack of direct interactions with instructors can weaken students' motivation and their sense of connection to course material (Barrot & Fernando, 2023; Noor & Isa, 2023; Sriwichai, 2020). Collectively, these factors contribute to increased procrastination and decreased engagement, leading to lower homework completion rates and academic performance, underscoring the need to address these motivational challenges.

Despite the increasing prevalence of online homework, the measurement of online homework motivation has largely been overlooked (Magalhães et al., 2020; Xu, 2022a; Xu et al., 2019). Prior studies have emphasized the need for valid instruments to assess motivational constructs in online learning settings, noting that existing tools do not adequately capture the unique aspects of online homework motivation. This oversight limits our understanding of how individual differences (e.g., self-regulation, prior experience) and contextual factors (e.g., course design, technology use) impact students' motivation to engage with online assignments. Without a valid instrument to measure this construct, advancing research that connects online homework motivation to its antecedents (e.g., individual and contextual differences) and outcomes (e.g., online homework completion) is challenging.

This study addresses the critical need to develop a valid and reliable instrument to understand the motivational factors influencing college students' engagement with online homework. By building on existing frameworks, such as the expectancy-value theory (Eccles & Wigfield, 2020; Wigfield et al., 2015) and drawing from relevant literature (Kosovich et al., 2015; Xu,

2023; Xu et al., 2019), we aim to provide a more comprehensive understanding of how motivation operates in the context of online homework. This understanding is essential for developing effective educational strategies that enhance student performance in online learning environments.

Research Aims

This study attempts to bridge the gap in understanding online homework motivation by validating the Online Homework Expectancy Value Cost Scale (OHEVCS) for college students. The specific objectives of this study are to:

a) Test the OHEVCS' structural validity, ensuring that the scale accurately represents the underlying motivational constructs of expectancy, value, and cost,
b) Examine its invariance over gender and college year to determine whether the motivational factors measured by the OHEVCS operate similarly across diverse student demographics,
c) Assess its reliability estimates, confirming that the OHEVCS provides consistent and stable measurements of online homework motivation,
d) Evaluate the validity of the evidence regarding its relationship with homework distraction, procrastination, and completion.

In exploring these objectives, it is vital to clarify how homework distraction, procrastination, and completion relate to the motivational factors measured by the OHEVCS. Homework distraction is non-academic activities diverting students' attention from their online assignments. Research indicates that such distractions can significantly impede students' engagement, negatively affecting motivation and completion rates (Koay & Poon, 2023; Sriwichai, 2020). Procrastination is a common behavior among students, often linked to low motivation and ineffective self-regulation strategies, which can adversely impact academic performance (Hassan et al., 2021). Understanding the relationship between procrastination and online homework motivation is essential for identifying interventions to enhance student engagement. Homework completion measures the extent to which students complete their online assignments. Higher motivation levels are typically associated with greater homework completion rates, making it a critical outcome for the present study (Zhu et al., 2024).

By achieving these objectives, the study seeks to provide a robust tool for measuring online homework motivation. Based on the identified relationships among these key constructs, the findings may contribute to developing strategies that enhance student engagement and performance in online homework assignments.

Literature Review

One theoretical framework that directly applies to online homework motivation is the expectancy-value theory (Eccles, 2005; Wigfield et al., 2015). This theory posits that motivation includes two main constructs that impact achievement-related outcomes (e.g., task persistence and completion): expectancy and value. Expectancy relates to the perceived likelihood of successfully executing an academic task; it addresses the question, "Can I Do This Task?" (Wigfield et al., 2015, p. 659). Value relates to the perceived worth or significance of an academic task. It addresses the question, "Do I Want to Do This Task?" (Wigfield et al., 2015, p. 659). Value can be broken down into four parts – attainment value (related to one's sense of identity), utility value (in terms of usefulness), intrinsic value (such as interest), and cost (about effort and time expenditure).

While attainment value, utility value, and intrinsic value underscore the positive valence of participating in an academic task, cost centers on the negative valence of the task. Whereas certain researchers maintain the view that cost ought to be regarded as part of the value (Perez et al., 2014), other researchers argue that it is imperative to treat cost separately for a more comprehensive comprehension of the motivational forces of what attracts or detracts students from participating in an academic task (Barron & Hulleman, 2015). Recent empirical studies have provided initial evidence that cost is a unique component (e.g., Jiang et al., 2018) in that cost was able to significantly account for extra variance across multiple achievement-related measures, exceeding the predictive power of expectancy and value.

Construct Measures: Expectancy, Value, and Cost

In our present study, we build on insights from three validation studies grounded in expectancy-value theory: (a) Expectancy-Value-Cost (EVC) Scale (Kosovich et al., 2015); (b) Homework Expectancy Value Cost Scale (HEVCS; Xu, 2023); and (c) Homework Expectancy Value Scale (HEVS; Xu et al., 2019). This study operationalizes three constructs based on expectancy-value theory: expectancy, value, and cost.

Expectancy reflects students' beliefs in their ability to complete online homework successfully. It is measured through items assessing self-efficacy, such as "If I do not understand something in online assignments, I often think I will never understand it."

Value pertains to online homework's perceived importance and usefulness for students' academic goals. It is assessed through items such as "Our online assignments are of little use to me" and "It makes barely any difference to me whether I do my online assignments or not."

Cost refers to the perceived drawbacks of completing online homework, including time investment, stress, and distractions. This construct is assessed through items like "My online assignments require too much time" and "I have to give up too much to succeed in my online assignments."

These three constructs are crucial for understanding the motivational dynamics in online homework contexts. Although not examining homework specifically, Kosovich and colleagues (2015) validated the EVC scale involving students in grades 6-8 about their science and mathematics courses (e.g., "I believe that I can be successful in [math or science] class"; "I think my [math or science] class is useful"; and "I am unable to put in the time needed to do well in my [math or science] class"). Empirical evidence from the confirmatory factor analysis (CFA) supported the existence of the three subscales (expectancy, value, and cost) in science (CFI = .99; RMSEA = .04; SRMR = .03) and mathematics (CFI = .99; RMSEA = .03; SRMR = .03). Furthermore, Kosovich et al. reported that their study supported measurement invariance of the EVC over gender and school subject (science vs mathematics).

In the context of mathematics homework, Xu (2023) validated the HEVCS involving students in grades 7-8. CFA findings provided empirical evidence for the three factors of the HEVCS (expectancy, value, and cost; CFI = .973; RMSEA = .046; SRMR = .029). Xu found no latent mean differences over gender and grade level. In line with theoretical predictions, homework expectancy and value were associated negatively with homework procrastination and positively with homework completion, effort, and achievement. Homework cost is positively associated with homework procrastination and negatively correlated with homework completion, effort,

and achievement. Additionally, homework cost remained a significant predictor of variance in homework procrastination, effort, completion, and achievement when accounting for gender, grade level, homework value, and expectancy.

Regarding online homework assignments, Xu et al. (2019) validated the HEVS involving college students. Unlike the two studies discussed above, the HEVS was limited to homework expectancy and value (i.e., without including another subscale relating to cost). CFA findings revealed that online homework value and expectancy were factorially distinct (CFI = .991; RMSEA = .028; SRMR = .030). In addition, there were no latent mean differences across gender. Finally, online homework value and expectancy were associated negatively with homework distraction and positively with homework completion.

To sum up, while two validation studies involving middle school students with science/mathematics classes (Kosovich et al., 2015) and mathematics homework (Xu, 2023) incorporated a subscale relating to the cost component, one validation study involving college students in the context of online homework assignments was limited to expectancy and value (Xu et al., 2019). As online homework becomes a growing and global phenomenon that poses novel motivational challenges for many college students without the social and academic support commonly available in face-to-face environments (Magalhães et al., 2020; Xu, 2022a; Zhou et al., 2017), it is imperative to address this gap by integrating cost, along with expectancy and value, within the landscape of online homework assignments.

Research Framework

Our current study aims to validate the Online Homework Expectancy Value Cost Scale (OHEVCS) for college students. The specific purposes are (a) testing the OHEVCS' structural validity; (b) examining its invariance over gender and college year; (c) assessing its reliability estimates; and (d) evaluating its validity evidence regarding its relations with homework distraction, procrastination, and completion. In line with theoretical predictions (e.g., task engagement, persistence, and completion; Eccles & Wigfield, 2020; Wigfield et al., 2015) and previous studies (Kosovich et al., 2015; Xu, 2023; Xu et al., 2019), the research framework integrates the constructs of expectancy, value, and cost with key variables identified from the literature – homework distraction, procrastination, and completion, which is grounded in the expectancy-value theory and validated by prior research.

First, expectancy is vital because students' beliefs about their ability to succeed significantly influence their motivation. Research shows that higher expectancy leads to greater effort and persistence in academic tasks (Eccles & Wigfield, 2020; Xu, 2022a). By including expectancy, we can examine how confidence impacts online homework completion. Second, value (i.e., the perceived importance of homework) is another essential factor. Students who view their assignments as relevant and beneficial are more likely to engage with them. Eccles and Wigfield (2020) emphasize the roles of intrinsic and extrinsic values in motivation, highlighting the need to understand how students perceive the value of online homework to enhance their motivation and completion rates. Third, the cost reflects the perceived homework challenges, such as time constraints and stress. Research indicates that when students perceive high costs, they may disengage from their assignments (Xu, 2022b; Xu, 2023). Including cost allows us to explore how these perceptions can hinder motivation and completion. Fourth, homework distraction is a significant barrier to focus and engagement in online learning environments. Studies have shown that increased distraction correlates with higher procrastination and lower completion rates (Xu et al., 2020). Understanding how distraction interacts with the other constructs can

help identify specific barriers to homework completion. Fifth, procrastination, a behavioral outcome of motivational challenges, directly affects completion rates. Research indicates that students with poor self-regulation often struggle with procrastination, impacting their homework success (Magalhães et al., 2020; Xu, 2022a). Analyzing procrastination about expectancy, value, and cost provides insights into effective strategies to improve engagement. Sixth, homework completion is the outcome we seek to understand, reflecting students' success in engaging with online homework (Xu, 2022b). This construct is influenced by the other factors in the framework, making measuring completion alongside expectancy, value, cost, distraction, and procrastination essential.

We hypothesize that Online Homework Expectancy and Value will be negatively associated with homework distraction and procrastination while being positively associated with homework completion. Conversely, we expect online homework cost to be positively associated with online homework distraction and procrastination and negatively associated with online homework completion (See Figure 1).

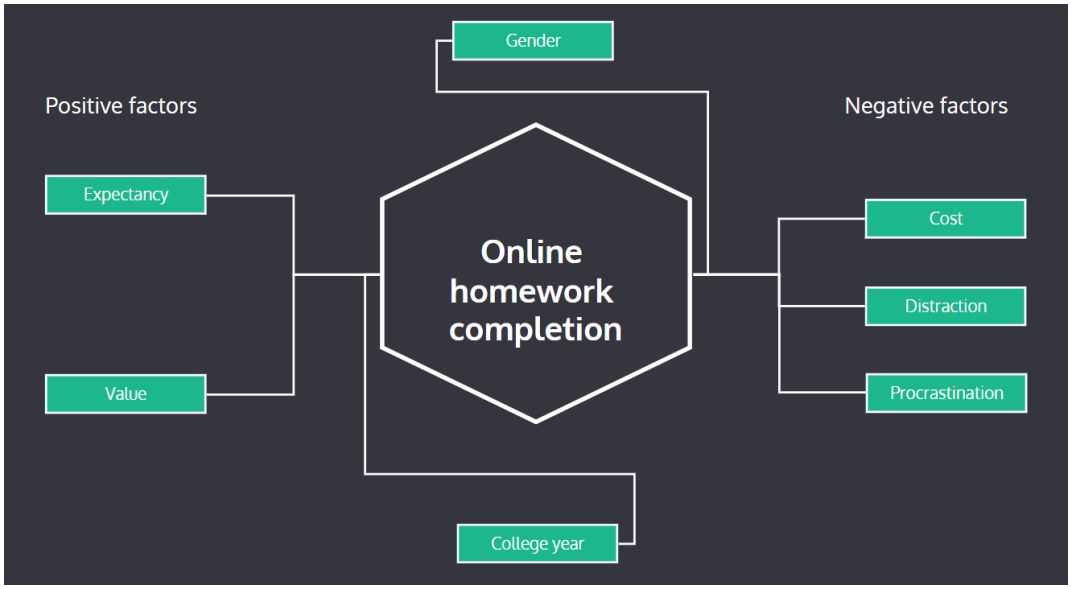

Figure 1: The Research Framework

Regarding gender and college year differences, congruent with a validation study involving college students (Xu et al., 2019), we hypothesize that latent means for online homework value and expectancy will be invariant across genders. Meanwhile, the study by Xu et al. (2019) did not investigate latent mean invariance in (a) online homework cost over gender and (b) online homework cost, expectancy, and value over college years (years 1-2 vs years 3-4). Consequently, it would be desirable to examine these differences; as individuals become increasingly conscious of age-appropriate developmental activities (Eccles, 2005), they might perceive a heightened cost associated with engaging in online homework assignments, for instance.

Method

Participants

Due to logistical reasons such as resources and time constraints, the authors adopted a convenience sampling method, a widely used non-probabilistic sampling technique in social

sciences research (Galloway, 2005). This approach enabled the collection of a diverse range of opinions and attitudes via an online survey form. After receiving ethical research approval from the faculty ethical research committee, the authors sent research participation invitation emails to all students (n = 2,352) in the foreign languages department of a large public university in the South of Vietnam during the 2022-2023 academic year. A total of 1,192 students (a participation rate of 50.8%) volunteered to participate in the study.

In terms of college status, first-year students accounted for 36.2%, second-year students accounted for 24.7%, third-year students accounted for 19.5%, and fourth-year students accounted for 19.6%. The average age among the participants was 20.4 years, with a standard deviation of 1.32 years. Separate analyses were performed for lower-division students (years 1-2) and upper-division students (years 3-4) to account for students' unique experiences and perspectives at different stages of their academic journey, thereby avoiding potential distortions in the analysis and discussion.

Our investigation was part of a larger research project examining various issues relating to online homework assignments (e.g., motivation and self-regulated learning). Participants came from several majors offered at the university (e.g., Business English, TESOL, Business Chinese). Online homework assignments included multiple-choice quizzes, writing tasks, discussion boards, and reflective journals. The survey was conducted online, with participants instructed to concentrate their responses on a single mandatory course in their major.

Instruments: Online Homework Expectancy Value Cost Scale (OHECVS)

The OHEVCS includes items designed to measure students' expectancy, value, and cost beliefs regarding online homework. These items were adapted from validated scales and tailored to the online homework context to ensure content validity. In particular, the development of the Online Homework Expectancy Value Cost Scale (OHECVS) was informed by two existing validated scales: the Homework Expectancy Value Scale (HEVS) for college students (Xu et al., 2019) and the Homework Expectancy Value Cost Scale (HEVCS) for middle school students (Xu, 2023). These scales are rooted in the expectancy-value theory, which is central to understanding student motivation in educational psychology. According to this theory, students' motivation to engage in a task is determined by their beliefs about their ability to succeed (expectancy), the importance they place on the task (value), and their perception of the effort and sacrifices required (cost).

Expectancy reflects students' beliefs about their capabilities to perform specific tasks successfully (Barron & Hulleman, 2015; Eccles & Wigfield, 2020; Jiang et al., 2018; Kosovich et al., 2015; Xu, 2017, 2022a, 2023; Xu et al., 2019; Yang & Xu, 2018). This construct was measured by four items (items 1-4 in Table 1; reverse scored) that assessed students' confidence and self-efficacy regarding online assignments. For example, items gauged whether students felt they could follow through with assignments or whether they anticipated difficulties that would prevent them from completing the tasks.

Value captures the perceived importance and usefulness of online assignments (Barron & Hulleman, 2015; Eccles, 2005; Eccles & Wigfield, 2020; Jiang et al., 2018; Kosovich et al., 2015; Perez et al., 2014; Xu, 2017, 2022a, 2023; Xu et al., 2019; Yang & Xu, 2018). This construct was measured by four items (items 5-8 in Table 1; reverse scored) that assessed how beneficial students found the assignments in helping them understand course materials. Items

in this category evaluated students' intrinsic and extrinsic value beliefs, such as the perceived relevance of assignments to their academic goals and personal interests.

Cost involves students' perceptions of the negative aspects associated with engaging in online assignments, such as the effort required and the potential loss of time for other preferred activities (Barron & Hulleman, 2015; Eccles & Wigfield, 2020; Jiang et al., 2018; Kosovich et al., 2015; Perez et al., 2014; Xu, 2023). This construct was measured by four items (items 9-12 in Table 1), which tapped into the perceived effort needed and the sacrifices students felt they had to make, such as giving up social activities with peers.

A 4-point Likert scale was used for all items, with responses ranging from 1 (strongly disagree) to 4 (strongly agree). Reverse scoring was applied to expectancy and value items to ensure consistency in interpretation, where higher scores indicated higher levels of expectancy, value, and perceived cost. This scoring method helped to accurately reflect the constructs measured and allowed for a clear understanding of students' motivational beliefs, engagement, and performance related to online homework assignments.

Motivational beliefs form the foundation for how students approach online homework. Expectancy, value, and cost significantly impact motivation levels, influencing students' willingness to engage with assignments. Research shows that positive motivational beliefs increase enthusiasm and persistence in academic tasks (Baron et al., 2015; Eccles, 2005; Eccles & Wigfield, 2020; Jiang et al., 2018; Ryan & Deci, 2020).

Engagement refers to students' active involvement and commitment in their learning processes. Higher levels of expectancy and value often lead to increased engagement, as students are more likely to participate fully in meaningful tasks and believe they can succeed. Engaged students generally exert more effort and are less likely to procrastinate, resulting in higher completion rates (Barrot & Fernando, 2023; Koay & Poon, 2023; Noor & Isa, 2023).

Performance encompasses the outcomes of students' efforts, including completing online homework assignments. The literature consistently demonstrates that positive motivational beliefs and higher levels of engagement correlate with improved academic performance (Hassan et al., 2021; Magalhães et al., 2020). Measuring these constructs offers valuable insights into the factors contributing to student's success in online homework contexts.

Table 1: Items and Standardized Coefficients

Latent construct	**Item**	*β*
Expectancy	1. "If I do not understand something in online assignments, I often think I will never understand it."	0.745
	2. "If I do not understand something in online assignments, I am at a complete loss and do not know how to catch up."	0.707
	3. "Whether or not I do my online assignments, I do not understand a thing in the lesson anyway."	0.760
	4. "I sometimes really dread online assignments."	0.553
Value	5. "Our online assignments are of little use to me."	0.770
	6. "I do not learn much from our online assignments"	0.827
	7. "There is no point in my doing online assignments."	0.786
	8. "It makes barely any difference to me whether I do my online assignments or not."	0.835
Cost	9. "My online assignments require too much time."	0.793
	10. "Because of other things that I do, I do not have time to put into my online assignments."	0.852
	11. "I am unable to put in the time needed to do well in my online assignments."	0.813
	12. "I must give up too much to do well in my online assignments."	0.771

[a]Item was reverse scored.

Data Analysis

To achieve the research aims, the OHEVCS was subjected to rigorous analysis. The structural validity of the scale was first tested using CFA to assess the fit of a three-factor model comprising expectancy, value, and cost constructs. Latent mean invariance was examined across (a) online homework cost, expectancy, and value by gender and (b) online homework cost, expectancy, and value by college year (years 1-2 vs. years 3-4).

The reliability of the OHEVCS was evaluated using both alpha and omega coefficients. For validity assessment, correlations between OHEVCS constructs and key variables were examined. Multiple regression analyses were conducted to explore predictive relationships. Detailed data analysis is presented in the following four stages.

Stage 1: Analyses were performed in Mplus, using robust maximum likelihood estimation. Our data featured low missing values (less than 1%), resolved through full information maximum likelihood.

CFAs were performed to empirically examine whether online homework expectancy, value, and cost were loaded on separate factors. The fit across five rival models was compared: one one-factor model (12 items loading on a single factor; Table 2), three two-factor models (12 items loading on two of the three constructs), and one three-factor model (12 items loading on respective constructs of online homework expectancy, value, and cost).

Table 2: Comparing Alternative Models

Model	*MLR*χ^2	*df*	RMSEA	RMSEA 90% CI	SRMR	CFI	TLI	AIC	BIC
One-factor model									
1 F1 (items 1-12)	1433.228	54	.146	.140 - .153	.114	.718	.656	27525.825	27708.827
Two-factor model									
2 F1 (items 1-8); F2 (items 9-12)	970.320	53	.120	.114 - .127	.105	.813	.767	26870.987	27059.072
3 F1 (items 1-4, 9-12); F2 (items 5-8)	992.108	53	.122	.115 - .129	.108	.808	.761	26905.347	27093.432
4 F1 (items 5-12); F2 (items 1-4)	658.188	53	.098	.091 - .105	.054	.876	.846	26442.679	26630.764
Three-factor model									
5 F1 (items 1-4); F2 (items 5-8); F3 (items 9-12)	182.371	51	.046	.039 - .054	.035	.973	.965	25785.971	25984.223

To assess model fit, we employed conventional goodness-of-fit indices based on recommended cutoffs by Hu and Bentler (1999): CFI of 0.95 or greater, SRMR of 0.08 or less, and RMSEA of 0.06 or less. Additionally, we evaluated model fit by generating the Dynamic Fit Index cutoffs, as this approach takes into account the specific characteristics of a factor solution (e.g., sample size, number of latent factors, number of items, loadings, error variance, and the correlation between latent factors; McNeish & Wolf, 2023).

Stage 2: Invariance tests were carried out over gender (males vs. females) and college year (years 1-2 vs. years 3-4) – configural, factor loading, intercept, and factor means invariance. Given the sensitivity of the chi-square test to sample size (Peugh & Feldon, 2020), we followed the following recommendation (Chen, 2007): a change in RMSEA < 0.015 and CFI < 0.01 indicated invariance.

Stage 3: As previous validation studies used the alpha coefficients (e.g., homework value; Xu, 2017; Yang & Xu, 2018), as recent research suggests that alpha may underestimate reliability (Deng & Chan, 2017), the present investigation encompassed both alpha and omega estimates to provide a comprehensive assessment of the reliability for the OHEVCS subscales.

Stage 4: When validating the OHEVCS, we considered three external indicators: homework distraction, procrastination, and completion.

Online Homework Distraction. Drawn from prior research (Xu et al., 2020), four items measured online homework distraction (e.g., "Stop online assignments to send or receive text messages"; α = .87; ω = .88). Participants made responses applying 5-point format (1 = *never*; 5 = *routinely*). CFA findings indicated that the four items formed a unidimensional measure of online homework distraction (CFI = 1.000; TLI = 1.000; RMSEA =.000; SRMR = .004).

Online Homework Procrastination. Based on extant literature (Xu, 2022b; Yockey, 2016), this scale assessed students' tendency to procrastinate on online assignments (4-item; e.g., "I put off online assignments until the last minute"; α = .80; ω = .81). Participants responded applying 4-point format from 1 (*strongly disagree*) to 4 (*strongly agree*). CFA findings indicated that the four items formed a unidimensional measure of online homework procrastination (CFI = 1.000; TLI = .997; RMSEA =.020; SRMR = .006).

Online Homework Completion. Guided by previous studies (e.g., Xu et al., 2019), students responded to a single item, assessing the extent to which they completed their online homework, with response options ranging from 1 (*none*) to 5 (*all*). As theorized, Xu (2023) showed that homework completion was negatively related to homework distraction and procrastination.

Validity evidence was assessed by examining zero-order correlations between the OHEVCS, homework distraction, procrastination, and completion. Additionally, multiple regression analyses were performed to test if online homework cost significantly predicted online homework distraction, procrastination, and completion when accounting for gender, college year, online homework value, and expectancy.

Results

Stage 1: OHEVCS' Structural Validity

The means of all items (Table 1) fell within the range of 2.33 to 3.00 ($0.69 \leq SD \leq 0.84$). In addition, all skewness and kurtosis values for these items were below an absolute value of 1.00. Results showed that, compared with the one-factor model ($MLR\chi^2$ = 1433.228; df = 54; CFI = .718; TLI = .656; RMSEA = .146; SRMR = .114; AIC = 27525.825; BIC = 27708.827), the fit of the three-factor model was significantly superior (Table 2; $MLR\chi^2$ = 182.371; df = 51; CFI = .973; TLI = .965; RMSEA = .046; SRMR = .035; AIC = 25785.971; BIC = 25984.223). Whereas the general fit of Models 2-4 showed improvement compared to Model 1 ($.090 \leq \Delta CFI \leq .158$; $.024 \leq \Delta RMSEA \leq .048$), Model 5 exhibited a further improvement compared to Models 2-4 ($.097 \leq \Delta CFI \leq .165$; $.052 \leq \Delta RMSEA \leq .076$). Hence, online homework cost, value, and expectancy were empirically distinguishable.

Our hypothesized model (Model 5) met the commonly used criteria recommended by Hu and Bentler (1999) as well as the ideal cutoff values based on the Dynamic Fit Index (SRMR = .098; RMSEA = .069; CFI = .960; McNeish & Wolf, 2023). The standardized factor loadings for all items, spanning .553 to .852, were substantial, lending further support to the three-factor model (Table 1). The correlations between the factors reached significance at the $p < .001$ level: 'Online Homework Expectancy' with 'Online Homework Value', .359; 'Online Homework Expectancy' with 'Online Homework Cost', −.321; and 'Online Homework Value' with 'Online Homework Cost', −.767.

Stage 2: Tests of Invariance

Measurement invariance across gender was tested. The configural invariance model indicated a good fit (CFI = .972; RMSEA = .048; Table 3). Imposing equality constraints on factor loadings maintained good fit (CFI = .972; RMSEA = .046), with minimal change in fit (ΔCFI < .001; ΔRMSEA = .002). Intercept invariance was further supported (CFI = .969; RMSEA = .046), with negligible change in fit (ΔCFI = .003; ΔRMSEA < .001). Finally, latent mean invariance held (CFI = .968; RMSEA = .047), with trivial declines in fit (ΔCFI = .001; ΔRMSEA = .001), signifying invariant latent means across gender.

Table 3: Tests of Invariance Across Gender and College Year

Invariance models	*MLRχ^2*	*df*	*RMSEA*	*RMSEA 90% CI*	*SRMR*	*CFI*	*TLI*	*Model Comparison*	*Δdf*	*ΔCFI*	*ΔRMSEA*
Gender											
1. Configural	240.109	102	.048	.040 - .056	.037	.972	.964	----	----	----	----
2. Factor loading	251.749	111	.046	.039 - .054	.040	.972	.967	2 vs. 1	9	< .001	.002
3. Intercept	274.022	120	.046	.039 - .054	.040	.969	.966	3 vs. 2	9	.002	< .001
4. Latent factor mean	282.686	123	.047	.040 - .054	.045	.968	.966	4 vs. 3	3	.001	.001
College year											
1. Configural	241.132	102	.048	.040 - .056	.038	.972	.964	----	----	----	----
2. Factor loading	250.846	111	.046	.038 - .054	.040	.972	.967	2 vs. 1	9	< .001	.002
3. Intercept	267.157	120	.045	.038 - .053	.041	.971	.968	3 vs. 2	9	.001	.001
4. Latent factor mean	271.453	123	.045	.038 - .052	.041	.970	.968	4 vs. 3	3	.001	< .001

Invariance was examined across college years, comparing lower (years 1-2) and upper (years 3-4) division students. The configural invariance model showed a very good fit (CFI = .972; RMSEA = .048). Constraining the factor loadings to be equal for both groups did not meaningfully worsen model fit (CFI = .972; RMSEA = .046), with minimal change in fit statistics (ΔCFI < .001; ΔRMSEA = .002). Intercept invariance also supported (CFI = .971; RMSEA = .045), with negligible decline in fit (ΔCFI = .001; ΔRMSEA = .001). Finally, latent mean invariance was supported (CFI = .970; RMSEA = .045), with trivial changes in fit (ΔCFI = .001; ΔRMSEA < .001), indicating invariant latent means over college year.

Furthermore, we conducted sensitivity analysis by constraining the loadings of different items: first, the loading of the second item of each factor; second, the loading of the third item; and third, the loading of the fourth item. We found negligible declines in model fit between Model 4 (the most constrained model) and Model 1 (the least constrained model). This indicates that gender and college year invariance are held, irrespective of the chosen anchor item.

Stage 3: OHEVCS' Reliability

The reliability estimates for the OHEVCS subscales were adequate and very good. The alpha coefficients were: .78 for online homework expectancy (.76 - .80), .88 for online homework value (.87 - .99), and .88 for online homework cost (.87 - .89). The corresponding omega coefficients were: .79 for expectancy (.76 - .80), .88 for value (.87 - .89), and .88 for cost (.87 - .89). By conventional standards (Nunnally, 1978; Watkins, 2017), these estimates indicate sufficient to very good reliability for research use.

Stage 4: OHEVCS' Validity Evidence

The relationships between the OHEVCS and the constructs of homework distraction, procrastination, and completion were examined (Table 4). As theorized (Eccles & Wigfield, 2020; Jiang et al., 2018), online homework completion was associated positively with online

homework value and expectancy and negatively with cost. Online homework distraction and procrastination were associated negatively with online homework value and expectancy and positively with cost. Additionally, online homework cost significantly predicted homework distraction, procrastination, completion, and mathematics when accounting for gender, college year, online homework expectancy, and value (Table 5). To provide evidence for the external aspect of construct validity, we examined the relationships between the OHEVCS and the constructs of homework distraction, procrastination, and completion (Table 4).

Tables 4*: Univariate Statistics and Bivariate Pearson Correlations*

Variables	M	SD	S	K	1	2	3	4	5	6	7
1 Gender (female = 0)	0.23	0.43	1.26	−0.41	–						
2 College year (Years 1−2 = 0)	0.39	0.49	0.45	−1.80	−0.08**	–					
3 Homework expectancy	2.68	0.64	−0.26	0.00	−0.04	−0.02	–				
4 Homework value	2.76	0.61	−0.40	0.40	−0.08**	−0.05	0.30**	–			
5 Homework cost	2.40	0.65	0.15	0.08	0.09**	0.03	−0.28**	−0.68**	–		
6 Homework distraction	2.69	0.96	0.36	−0.24	0.12**	−0.01	−0.37**	−0.30**	0.29**	–	
7 Homework procrastination	2.36	0.65	0.22	0.05	0.15**	0.05	−0.60**	−0.30**	0.30**	0.51**	–
8 Homework completion	4.22	0.76	−0.99	1.21	−0.13**	0.00	0.12**	0.19**	−0.20**	−0.12**	−0.26**

Note: N = 1,192. S = Skewness. K = Kurtosis. ***p* < .01.

Table 5: Using Hierarchical Regression Analyses to Predict Online Homework Distraction, Procrastination, and Completion

Variables	Homework distraction		Homework procrastination		Homework completion	
Gender (female = 0)	.09***	.09**	.12***	.12***	−.12***	−.11***
College year (Years 1−2 = 0)	−.02	−.02	.04	.04	.00	.00
Homework expectancy	−.31***	−.30***	−.56***	−.55***	.07*	.06*
Homework value	−.20***	−.12**	−.12***	−.07*	.16***	.08*
Homework cost		.12**		.09**		−.12***
Explained variance	18.1%	18.8%	39.1%	39.5%	5.1%	5.8%

Note: N = 1,192. **p* < .05. ***p* < .01. ****p* < .001.

To summarize, the results indicate significant relationships between online homework expectancy, value, cost, and other constructs such as online homework distraction, procrastination, and completion. These results underscore the importance of addressing motivational factors in online homework assignments.

Discussion

The present investigation validated the OHEVCS for undergraduates relating to online homework assignments. Results revealed that the OHEVCS possessed good psychometric properties. Specifically, the three-factor model demonstrated a significantly superior fit to the four alternative models, indicating that online homework expectancy, value, and cost represent distinct constructs. This distinction is crucial as it highlights the unique contributions of each construct to students' motivational dynamics in online homework settings.

Furthermore, in line with theoretical expectations (Wigfield et al., 2015), online homework value and expectancy exhibited a positive correlation but were inversely related to cost. Specifically, as indicated in Table 4, higher homework value positively correlated with homework completion (r = .19, p < .01) and negatively correlated with both homework distraction (r = -.30, p < .01) and procrastination (r = -.30, p < .01). This suggests that when students perceive high value in their assignments, they are more likely to engage effectively and less likely to procrastinate or become distracted. Conversely, perceived costs were positively associated with homework distraction (r = .29, p < .01) and procrastination (r = .30,

$p < .01$), highlighting that students who feel overwhelmed by the demands of their assignments are more likely to struggle with completion. This finding underscores the complex interplay between these motivational factors, where higher perceived value and expectancy can mitigate the negative impact of perceived costs.

Our study found no latent mean differences over gender and college years in the OHEVCS. The findings on the invariance of online homework expectancy and value align with the outcomes of a previous validation study involving Chinese undergraduates (Xu et al., 2019). However, the study by Xu et al. did not incorporate a subscale on Online Homework Cost, nor did it examine latent means difference in online homework expectancy and value across college years. Therefore, the current investigation extends previous studies by revealing that there was support for latent mean invariance in (a) online homework cost over gender and college and (b) online homework value and expectancy over college years. This invariance indicates that the OHEVCS can be reliably used across different demographic groups (e.g., gender, college year), providing a robust tool for measuring online homework motivation.

Regarding the OHEVCS' validity evidence, our results showed that consistent with theoretical expectations and previous studies (Eccles & Wigfield, 2020; Kosovich et al., 2015; Xu, 2023; Xu et al., 2019), online homework value and expectancy were associated positively with online homework completion, negatively with online homework distraction and procrastination. Conversely, online homework cost was positively associated with online homework distraction and procrastination and negatively associated with online homework completion. These findings provide a nuanced understanding of how motivational beliefs impact student behaviors. For instance, students who perceive high value and expectancy in their online homework are likelier to complete assignments and less likely to procrastinate or be distracted. On the contrary, high perceived costs can deter online homework completion and increase homework procrastination and distraction.

In addition, each subscale of the HEVCS (such as online homework cost) significantly predicted online homework distraction, procrastination, and completion, even when accounting for gender, college year, and the remaining two OHEVCS subscales (e.g., online homework expectancy, value). The OHEVCS appears to be a valid tool for assessing college students' motivational beliefs regarding online homework assignments, providing a comprehensive measure that can inform both research and practice.

Implications and Recommendations

This study provides several important implications for both research and practice. It contributes significantly to the literature by emphasizing the necessity of comprehensively considering online homework expectancy, value, and cost to understand college students' motivation toward online homework assignments. Our results, specifically the significant correlations found between the OHEVCS constructs and variables such as online homework distraction and procrastination, indicate that researchers can explore how these relationships may vary across different contexts and populations.

Understanding the relationships among constructs (e.g., online homework value positively correlating with completion and negatively with distraction) suggests that higher value and expectancy can mitigate the negative impact of perceived costs. This insight can lead to a deeper understanding of how various educational practices influence students' motivational beliefs and behaviors. Researchers might benefit from examining potential precursors of the OHEVCS,

such as the quality of teacher homework involvement (e.g., autonomy support and feedback quality; Yang & Xu, 2019). These investigations could help identify educational practices that enhance or detract from students' motivational beliefs and behaviors.

Motivational beliefs influence task engagement, persistence, and completion (Eccles & Wigfield, 2020; Xu, 2023). Given that our findings demonstrated a significant association between the OHEVCS and online homework distraction, procrastination, and completion, instructors may benefit from utilizing the OHEVCS as a useful tool for teaching and assessing students. By using the OHEVCS, instructors can better comprehend undergraduates' motivational beliefs about online homework assignments and assist in recognizing students struggling with distraction and procrastination regarding online homework completion.

In practice, utilizing the OHEVCS can inform instructors about engagement strategies that resonate most with their students. For instance, group discussions, peer collaborations, and interactive assignments can enhance the perceived value and expectancy while reducing distractions and procrastination.

Furthermore, the OHEVCS can help instructors design targeted interventions that address specific motivational challenges based on individual motivational profiles. For example, suppose students exhibit low expectancy beliefs (i.e., low confidence in completing online homework). In that case, instructors can enhance these beliefs by providing clear, positive feedback and recognizing students' past efforts and improvements. This could involve regular check-ins and personalized encouragement to boost students' self-efficacy. If students perceive low value in their online homework (i.e., they do not see its relevance or usefulness), instructors can connect homework tasks to students' personal goals and interests. This might involve explaining how the assignments contribute to broader learning objectives or future career opportunities. Incorporating real-world applications and examples can also help students see the practical value of their assignments.

To address high perceived costs (i.e., students feel that online homework requires too much time or effort), instructors can implement time management strategies and provide support to help students balance their workload. This could include breaking assignments into smaller, more manageable tasks, offering flexible deadlines, and providing resources for efficient study habits. Additionally, interventions should be designed to mitigate perceived costs by offering time management strategies and support. For example, instructors can teach students how to schedule their time effectively, set priorities, and develop a study routine that reduces the perceived burden of online homework. Providing tools such as online calendars (e.g., Google Calendar), reminder apps (e.g., Microsoft To-Do), time management methods (e.g., the Pomodoro Technique), and study groups can also help students manage their assignments more effectively.

Moreover, educational institutions can use the findings from this study to inform policy decisions and resource allocations. For example, universities might invest in professional development programs that train instructors to apply the OHEVCS in their teaching practices. By understanding the specific motivational challenges faced by their students, institutions can develop targeted support services, such as skill-building workshops, tutoring centers, counseling services, and mentorship opportunities that connect academic tasks with career pathways to enhance student motivation and academic success.

In conclusion, the OHEVCS is a valuable tool for understanding and improving college students' motivation toward online homework assignments. By addressing the distinct constructs of expectancy, value, and cost, educators and researchers can develop more effective strategies to enhance student engagement, reduce procrastination and distraction, and ultimately improve academic outcomes.

Conclusion

This study validates the OHEVCS as a reliable and valid instrument for assessing motivational beliefs related to online homework among college students. The scale offers a robust framework for understanding three key factors – online homework expectancy, value, and cost – influencing students' engagement with online assignments. Notably, online homework value and expectancy demonstrated positive correlations and were inversely related to cost. Latent mean differences across gender and college years were not found in the OHEVCS.

Additionally, online homework value and expectancy were positively associated with completion rates and negatively correlated with distraction and procrastination behaviors. Conversely, online homework cost showed positive associations with distraction and procrastination and negative associations with completion rates. These results underscore the utility of the OHEVCS in capturing motivational dynamics surrounding online homework among college students.

As motivational beliefs can be shaped by cultural variation (e.g., perceived competence, cost, and value of academic tasks such as online homework; Eccles & Wigfield, 2020; Wigfield et al., 2015), it would be beneficial to validate the OHEVCS in diverse national contexts. Future research should aim to replicate this study with more diverse samples, including students from different universities and various academic disciplines. This will enhance the generalizability of the findings and provide a broader understanding of student motivation in online homework contexts.

Moreover, further investigations of the OHEVCS could also focus on college students with unfavorable motivational beliefs about online homework assignments (high perceived cost and low perceived expectancy/value) and test interventions to improve their motivational beliefs and behaviors around online homework distraction, procrastination, and completion. Finally, since increasingly more online instructors have included online collaborative learning activities in their classes (Awuor et al., 2022; Xu et al., 2013), and since online collaborative homework poses unique challenges for undergraduates (e.g., social loafing and free-riding; Du et al., 2015; Greenhow et al., 2022), it is imperative to validate the OHEVCS in online collaborative environments.

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