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A Comparison of Two Instructional Approaches: Flipped and Self Determination - Based Methods in Enhancing Students' Self – Regulation

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In the context of Iranian higher education, where self-regulation is crucial for students' academic success amid evolving pedagogical approaches, this study examined the comparative effectiveness of two learner-centered instructional models—self-determination–based instruction (SDI) and flipped instruction—in enhancing university students' self-regulation. Participants included forty-five undergraduate psychology students from Islamic Azad University, Eslamshahr, who were assigned to two experimental groups and one control group. Each group received 10 structured instructional sessions, and students' self-regulation was assessed at pretest, posttest, and follow-up using the Motivated Strategies for Learning Questionnaire (MSLQ). For data analysis, two separate multivariate analyses of covariance (ANCOVA) were conducted for posttest and follow-up scores, with pretest scores entered as covariates to control for baseline differences among groups. Bonferroni-adjusted pairwise comparisons were performed to examine group differences. Results indicated that both instructional interventions significantly improved students' self-regulation compared with traditional instruction, with a large effect size (partial η^2 ranging from .36 to .41). The SDI group demonstrated the greatest gains and significantly outperformed the flipped instruction group. Effects remained stable from posttest to follow-up, indicating the durability of the intervention outcomes. By emphasizing autonomy, competence, and relatedness in instructional design, these findings highlight the theoretical and practical significance of self-determination principles in fostering enduring self-regulation skills in higher education, providing evidence-based guidance for curriculum developers and university instructors to enhance students' independent and self-directed learning capacities.

Keywords: flipped classroom, self-determination theory, self-regulated learning, quasi-experimental design, university students.

Self-regulation has emerged as a cornerstone of effective learning in contemporary educational environments, where students are increasingly expected to assume responsibility for their own learning processes (Panadero, 2017; Winne & Hadwin, 2013). Defined broadly, self-regulation refers to learners' ability to proactively plan, monitor, control, and reflect

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upon their cognitive, behavioral, motivational, and emotional processes in pursuit of personal and academic goals (Schunk & Greene, 2017; Zimmerman, 2002). This multidimensional construct—comprising cognitive, metacognitive, and motivational components—is strongly associated with academic achievement, motivation, resilience, and lifelong learning capacity (Cleary & Zimmerman, 2004; OECD, 2019).

Recent studies emphasize that learners with stronger self-regulatory capacities navigate technology-mediated and hybrid learning environments more effectively, personalize learning, and adapt to dynamic demands (Li & Xu, 2024; Martin et al., 2023; Zhao & Chen, 2025). Nonetheless, traditional teacher-centered instruction often fails to develop these skills, leaving students as passive recipients of knowledge and limiting opportunities for metacognitive engagement and autonomy (Chen et al., 2014; O'Flaherty & Phillips, 2015; Ryan & Deci, 2017).

Flipped learning reorders instruction by assigning knowledge acquisition (e.g., videos, readings) to out-of-class time and devoting classroom sessions to collaborative, application-oriented activities (Bergmann & Sams, 2012; Bishop & Verleger, 2013). Grounded in constructivist theory, it aims to enhance engagement, autonomy, and responsibility (O'Flaherty & Phillips, 2015; Thai et al., 2017). Empirical evidence indicates improvements in metacognitive regulation, time management, and goal setting (van Alten et al., 2020; Wu et al., 2021; Wu et al., 2024). Effectiveness varies by learners' prior self-regulation, motivation, and digital literacy; some students experience cognitive overload or anxiety (Abeysekera & Dawson, 2015; Aslan, 2021; Chen et al., 2025). Moreover, much

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evidence relies on Western or cross-sectional samples, limiting generalizability.

SDT provides a theoretical framework linking instructional environments to motivation and self-regulation (Deci & Ryan, 1985, 2000). It emphasizes the satisfaction of three basic psychological needs: autonomy, competence, and relatedness (Niemiec & Ryan, 2009). Meeting these needs fosters internalization of learning goals, self-regulated behaviors, and persistence (Vansteenkiste et al., 2020). Autonomy-supportive practices—such as offering choices, providing rationales, acknowledging feelings, and minimizing controlling language—promote intrinsic motivation and self-regulation (Jang et al., 2016; Reeve, 2012). Intervention studies show that SDT-based teaching increases engagement, metacognitive strategy use, and adaptive learning behaviors (Kim et al., 2022; Shank et al., 2025).

Critical evaluation: While robust, most studies focus on individual components of self-regulation or are limited to Western contexts, highlighting the need for comparative and localized investigations.

Flipped and SDT-based approaches support self-regulation via different mechanisms: Flipped classrooms provide temporal and structural opportunities for self-directed learning, whereas SDT-based instruction cultivates intrinsic motivation to utilize these opportunities. Despite extensive research on their individual effects, direct comparative studies on self-regulation are scarce, often discipline-specific, cross-sectional, or methodologically heterogeneous (Sun et al., 2023; Zhang & Zhang, 2023; Panadero, 2017). Additionally, non-Western

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contexts, such as Iran, remain underexplored, where cultural norms may influence autonomy support. The COVID-19 shift to online and hybrid learning further underscores the urgency of fostering self-regulation (Bao, 2020; Carter et al., 2020).

Building on the multidimensional nature of self-regulation, this study investigates cognitive, metacognitive, and motivational subcomponents, addressing the following questions:

1. To what extent do Flipped and SDT-based instructional methods improve cognitive, metacognitive, and motivational self-regulation compared to a control group?
2. Does SDT-based instruction lead to greater improvements across these subcomponents than Flipped instruction?
3. Are the gains in self-regulation produced by these instructional methods maintained at a one-month follow-up?

Drawing from the theoretical and conceptual framework, the study tests the following hypotheses:

H1. Both Flipped and SDT-based instructional methods will significantly improve students' self-regulation compared to the control group.

H2. SDT-based instruction will produce significantly greater posttest and follow-up self-regulation gains than Flipped instruction.

H3. Self-regulation improvements in both instructional groups will be sustained at the one-month follow-up without significant decline from posttest scores.

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Method

This study employed a quasi-experimental, applied research design with a pretest–posttest–follow-up and control group. The research was applied in purpose (aimed at solving a practical educational problem) and semi-experimental in execution. Three groups were compared: Flipped instruction, self-determination-based instruction, and control group.

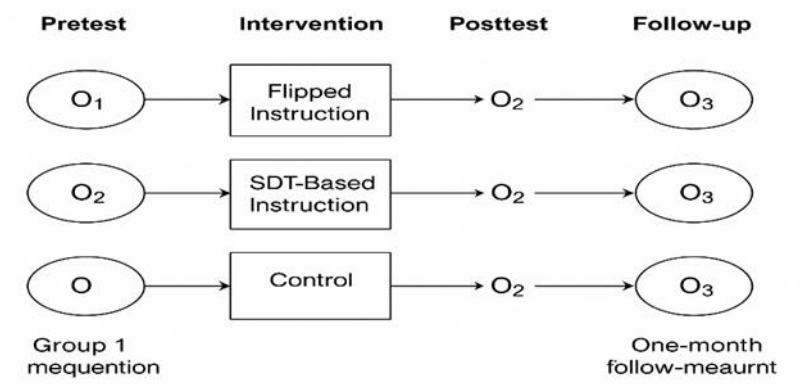


Figure 1. Diagram of the research

The design diagram of the study is as follows:
Where O1 = pretest measurement of self-regulation,
O2 = posttest measurement,
O3 = one-month follow-up measurement.

The study population comprised undergraduate students enrolled in the Faculty of Psychology at Islamic Azad University, Eslamshahr, during the 2024–2025 academic year. Due to feasibility constraints and the need to ensure participants' availability and informed consent, purposive sampling was first employed to recruit 45 eligible volunteers who met the inclusion

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criteria. Although purposive sampling may limit population-level generalizability, it was deemed appropriate for this controlled educational intervention. To ensure internal validity and group comparability, participants were subsequently randomly assigned to one of three groups (n = 15 per group) using stratified block randomization, balancing key demographic variables across conditions. This two-stage procedure minimized allocation bias and strengthened causal inference, consistent with CONSORT recommendations for quasi-experimental designs.

Inclusion Criteria

- Enrolled as full-time undergraduate students.
- Willingness to participate and attend all training sessions.
- No history of diagnosed psychological disorders affecting learning.

Exclusion Criteria

- Missing more than two training sessions.
- Withdrawal of consent at any stage.

Instruments

Motivated Strategies for Learning Questionnaire (MSLQ)

The Motivated Strategies for Learning Questionnaire (MSLQ) was developed by Pintrich and De Groot (1990) as a theory-driven instrument grounded in social-cognitive and self-regulated learning frameworks to assess students' motivational beliefs and learning strategies in academic contexts. The questionnaire is rated on a 7-point Likert scale ranging from 1 (not at all true of me) to 7 (very true of me), with higher scores

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reflecting stronger endorsement of self-regulated learning behaviors.

In the present study, the MSLQ was used to assess self-regulated learning through three theoretically related dimensions: cognitive strategies (13 items; e.g., rehearsal, elaboration, organization), metacognitive strategies (12 items; e.g., planning, monitoring, regulation), and resource management strategies (11 items; e.g., time management, effort regulation, help-seeking). Subscale scores were first computed by averaging item responses within each dimension to account for unequal item numbers. These subscale means were then aggregated to form a composite self-regulation score.

The decision to use a composite score was theoretically and analytically motivated. Conceptually, self-regulation is widely regarded as an integrative construct in which cognitive, metacognitive, and behavioral strategies operate synergistically rather than independently. Methodologically, the primary aim of the study was to compare the overall effectiveness of instructional approaches on students' global self-regulatory capacity, rather than to examine differential effects on specific strategy components. Aggregating subscales into a composite score therefore enhanced parsimony, reduced model complexity given the modest sample size, and increased statistical power.

Nevertheless, we acknowledge that aggregating subscales may obscure dimension-specific effects and should be interpreted as reflecting overall self-regulated learning competence rather than discrete strategic profiles. Readers interested in finer-grained analyses are encouraged to consider

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subscale-level investigations in future research with larger samples.

The psychometric properties of the MSLQ have been extensively validated across cultural contexts (Pintrich & De Groot, 1990; Duncan & McKeachie, 2005; Artino et al., 2012; Hilpert et al., 2013) and within Iranian samples (Hosseini Ravesh et al., 2022; Amirian et al., 2022), supporting its reliability, construct validity, and appropriateness for use in the present study.

Flipped Instruction

- Content Validity: Based on self-regulated learning theory; validated by three university experts. All sessions covered cognitive, metacognitive, and behavioral dimensions.

- Reliability: Pilot with n = 15 students showed α > 0.86 and inter-rater reliability κ = 0.81. Qualitative feedback prompted cultural adjustments emphasizing collaborative learning and group harmony.

Self-Determination-Based Instruction

- Content Validity: Designed on SDT principles; validated by motivation and learning experts. Pilot feedback ensured cultural relevance.

- Reliability: Test-retest α > 0.89 over two weeks; inter-rater agreement κ = 0.84. Adaptations emphasized autonomy-supportive practices within collectivist contexts.

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Table 1
Lesson Plan — Flipped Instruction (FI)

Session	Objective	Main Activities	Assessment
1	Introduction to self-regulation	Watch video before class; group discussion	Written pre-test
2	Setting SMART goals	Read article; workshop on goal setting	Written goals
3	Time management	Video; group activity on scheduling	Submitted schedule
4	Active learning strategies	Summarizing; group problem-solving	Participation score
5	Self-monitoring	Learning journal; progress report	Checked journals
6	Problem-solving	Real scenario; group discussion	Quality of solution
7	Cognitive flexibility	Simulation game	Observed behavior
8	Self-assessment	Mock test	Test analysis
9	Future planning	Long-term plan drafting	Submitted plan
10	Wrap-up	Experience sharing; feedback	Post-test

The instructional plan for the Flipped classroom method was designed to foster active learning and engagement by requiring students to review key concepts before class and then apply their knowledge during interactive classroom sessions. Over ten weekly sessions, students were provided with pre-recorded lectures, reading materials, and quizzes to complete before each class meeting. The in-class activities emphasized collaborative problem-solving, critical thinking exercises, and guided reflection, encouraging students to take responsibility for their own learning. Early sessions focused on setting personal academic goals and developing effective time-management and study strategies, while later sessions aimed to enhance cognitive flexibility and future planning. The Flipped approach was

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structured to help students practice self-regulation by shifting the responsibility for learning outside the classroom and using classroom time for deeper exploration and feedback.

Table 2
Lesson Plan — Self-Determination-Based Instruction (SDI)

Session	Objective	Main Activities	Assessment
1	Intrinsic motivation	Open discussion; share experiences	Participation quality
2	Personal goal selection	Write individual goals	Recorded goals
3	Competence building	Gradual tasks; positive feedback	Measured progress
4	Free choice	Choose assignment type	Satisfaction survey
5	Skill reinforcement	Problem-solving at appropriate level	Individual progress
6	Empathy and connection	Peer-supported group work	Group evaluation
7	Overcoming barriers	Identify motivational barriers	Proposed strategies
8	Feedback	Individual and peer feedback	Feedback quality
9	Goal revision	Review and adjust goals	New goals
10	Sense of belonging	Celebrate achievements; appreciation	Post-test

In contrast, the self-determination theory (SDT)-based instructional plan prioritized fostering intrinsic motivation by supporting students' autonomy, competence, and relatedness needs, as outlined by Deci and Ryan's theory. This ten-session plan included activities such as open discussions, personal goal writing, free-choice assignments, and group empathy exercises. The instructor provided constructive feedback and created opportunities for students to share experiences and celebrate achievements, thereby reinforcing their sense of agency and belonging. The sessions were deliberately designed to minimize controlling behaviors and instead create a supportive

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environment in which students felt empowered to direct their own learning. Exercises such as identifying personal barriers, revising goals, and reflecting on progress were incorporated to strengthen self-awareness and persistence.

Table 3
Comparative Table of the Two Instructional Methods

Method	*Overall Goal*	*Techniques*	*Exercises*
Flipped Instruction	*Enhance cognitive and behavioral skills*	*Pre-class study, quizzes, problem-solving*	*Learning journal, group activities*
Self-Determination-Based Instruction	*Enhance intrinsic and volitional motivation*	*Free choice, positive feedback, social support*	*Personal goal setting, goal revision*

Table 4
Overview of Lesson Plans for Each Instructional Method

Session	Flipped Instruction Activities	SDT-Based Instruction Activities
1	Watch video + discussion	Open discussion; experience sharing
2	SMART goal setting workshop	Write personal goals
3	Time management practice	Build competence with gradual tasks
4	Active learning strategies	Free-choice assignments
5	Self-monitoring journal	Reinforce skills
6	Problem-solving exercises	Group empathy work
7	Cognitive flexibility game	Identify barriers
8	Mock test + reflection	Individual and peer feedback
9	Future planning draft	Revise goals
10	Sharing experiences + feedback	Celebrate achievements

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When comparing the two instructional approaches, both were effective in enhancing students' self-regulation but achieved this through different mechanisms. The Flipped classroom method emphasized structured, strategy-based learning, promoting metacognitive awareness and accountability through pre-class preparation and active participation. This approach leveraged external structure to help students develop internal control over their learning processes. On the other hand, the SDT-based method focused more on the motivational and emotional dimensions of self-regulation by creating a learning climate that supported autonomy and self-directed goal setting. While the Flipped method fostered cognitive and behavioral aspects of self-regulation, the SDT-based method more strongly addressed students' internal motivation and resilience. Together, these findings highlight how distinct pedagogical strategies can complement one another in cultivating comprehensive self-regulated learning skills.

After obtaining institutional ethics approval (Approval Code: pending finalization) and informed consent, eligible students were randomly assigned to one of three groups. Both intervention groups attended 10 weekly 90-minute sessions led by the same trained instructor. The Flipped instruction group completed pre-class materials and engaged in collaborative in-class activities. The SDT-based group participated in autonomy-supportive, competence-enhancing, and relatedness-building activities. The control group continued their usual coursework without intervention. Intervention fidelity was monitored via session checklists completed by an independent observer, achieving 92% adherence.Self-regulation scores were measured

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at pretest, immediate posttest, and one-month follow-up, ensuring standardized and reliable measurement across groups.

Ethical Considerations

All participants provided informed consent, were assured of confidentiality, and informed of their right to withdraw at any time without penalty. Data were anonymized and stored on password-protected university servers. Sample size (n = 45) was determined via G*Power for detecting medium effects (f = 0.25) at 80% power with $\alpha = 0.05$. The interventions posed no known risk to participants.

Results

Data were analyzed using univariate analysis of covariance (ANCOVA) to examine the effects of instructional methods on students' self-regulation. Two separate ANCOVA models were conducted for posttest and follow-up scores. In both analyses, group (Control, Flipped Instruction, and Self-Determination-Based Instruction) was treated as the independent variable, posttest or follow-up self-regulation scores as the dependent variable, and pretest self-regulation scores as the covariate to control for baseline differences among participants.

Preliminary assumption testing confirmed that all assumptions for ANCOVA were met. The data were approximately normally distributed, homogeneity of variances was supported, and the assumption of homogeneity of regression slopes was satisfied. Therefore, the use of ANCOVA was appropriate.

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Table 5
Descriptive Statistics of Self-Regulation Scores

Group	Pretest Mean (SD)	Posttest Mean (SD)	Follow-up Mean (SD)
Control	40.20 (5.31)	40.67 (4.78)	40.33 (5.79)
Flipped Instruction	41.47 (4.42)	54.07 (5.93)	52.64 (6.62)
Self-Determination-Based Instruction	41.60 (4.78)	67.20 (5.57)	66.05 (5.21)

As shown, the control group exhibited minimal change, whereas both experimental groups demonstrated substantial improvements from pretest to posttest, which were largely maintained at follow-up. The Self-Determination-Based Instruction (SDI) group showed the highest gains.

ANCOVA Results for Posttest Self-Regulation

An ANCOVA was conducted to compare posttest self-regulation scores across groups while controlling for pretest scores. To examine the effectiveness of instructional methods on students' self-regulation, two separates univariate ANCOVA models were conducted for posttest and follow-up scores while controlling for pretest differences.

Table 6
ANCOVA Results for Posttest Self-Regulation (Controlling for Pretest)

Source	Sum of Squares (SS)	df	Mean Square (MS)	F	p	Partial η^2
Pretest (Covariate)	512.84	1	512.84	11.29	< .001	.30
Group	1702.56	2	851.28	18.74	< .001	.41
Error	3865.12	85	45.47	—	—	—
Corrected Total	6080.52	88	—	—	—	—

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For the posttest stage, the ANCOVA results revealed a statistically significant effect of group on self-regulation after adjusting for pretest scores ,$F(85,2)=18.74$, $p<.001$, $\eta p^2 = .41$. The covariate (pretest self-regulation) was also statistically significant, $F(88,1)=11.29$, $p<.001$, $\eta p^2 = .30$, indicating that baseline differences contributed meaningfully to posttest outcomes. The effect size for group was large, suggesting that a substantial proportion of variance in posttest self-regulation scores can be attributed to the type of instructional method. So, the results indicated a statistically significant effect of group on posttest self-regulation after controlling for pretest scores, with a large effect size.

Pairwise Comparisons (Posttest)

Bonferroni-adjusted pairwise comparisons were conducted to examine differences between groups.

Table 7
Bonferroni Pairwise Comparisons for Posttest

Comparison	Mean Difference	p
Flipped vs. Control	12.84	< .001
SDI vs. Control	25.97	< .001
SDI vs. Flipped	13.13	< .001

Bonferroni-adjusted pairwise comparisons indicated that both the Flipped Instruction and Self-Determination-Based Instruction (SDI) groups scored significantly higher than the control group at posttest ($p<.001$) Furthermore, the SDI group significantly outperformed the Flipped Instruction group

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)(p<.001) demonstrating its superior effectiveness in enhancing students' self-regulation.

These results show that both instructional methods significantly outperformed the control group, and the SDI method was significantly more effective than the Flipped Instruction.

ANCOVA Results for Follow-Up Self-Regulation

A second ANCOVA was conducted to examine group differences at follow-up while controlling for pretest scores.

Table 8
ANCOVA Results for Follow-Up Self-Regulation (Controlling for Pretest)

Source	Sum of Squares (SS)	df	Mean Square (MS)	F	p	Partial η^2
Pretest (Covariate)	468.37	1	468.37	10.11	<.001	.28
Group	1345.92	2	672.96	14.52	<.001	.36
Error	3940.28	85	46.36	—	—	—
Corrected Total	5754.57	88	—	—	—	—

At the follow-up stage, ANCOVA results again showed a significant effect of group ,F (88, 2) =14.52 (p<.001), $\eta p^2 = .36$, after controlling for pretest scores. The covariate remained significant ,F(85,1)=10.11, p<.001 ,$\eta p^2 = .28$. The magnitude of the effect size indicates that the instructional interventions continued to exert a strong influence on students' self-regulation over time. The findings revealed a significant effect of

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instructional method at follow-up, indicating that the differences among groups persisted over time.

Pairwise Comparisons (Follow-Up)

Table 9

Bonferroni Pairwise Comparisons for Follow-Up

Comparison	Mean Difference	p
Flipped vs. Control	12.31	< .001
SDI vs. Control	24.88	< .001
SDI vs. Flipped	12.57	< .001

Post hoc comparisons with Bonferroni adjustment revealed that both experimental groups maintained significantly higher self-regulation scores than the control group at follow-up ($p<.001$) In addition, the SDI group continued to demonstrate significantly greater effectiveness compared to the Flipped Instruction group ($p<.001$)indicating that its impact was not only stronger but also more enduring. Overall, these findings provide robust evidence that both instructional approaches are effective in improving self-regulated learning, with Self-Determination-Based Instruction yielding the strongest and most sustained effects.

Interpretation in Relation to Hypotheses

- H1 was fully supported, as both instructional approaches significantly improved students' self-regulation compared to the control group.
- H2 was confirmed, as SDI consistently yielded greater improvements than Flipped Instruction at both posttest and follow-up.

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- H3 was also supported, indicating that instructional effects were sustained over time without significant decline.

Discussion

The present study reinforces the evidence that both Flipped and SDT-based instructional methods enhance students' self-regulated learning, but through distinct mechanisms: Flipped learning scaffolds cognitive and behavioral strategies, while SDT-based teaching fosters internal motivation and emotional engagement by satisfying psychological needs. The greater effectiveness of the SDT-based approach in this context highlights the foundational role of motivation in self-regulation, particularly in educational environments where students may initially rely on external guidance. These findings underscore the need to tailor instructional design to students' motivational and cognitive profiles and point toward the potential benefits of integrating structural and motivational scaffolding to optimize self-regulated learning outcomes.

The present study examined the comparative effectiveness of two contemporary instructional methods—flipped classroom and self-determination theory (SDT)-based approaches—in enhancing university students' self-regulated learning. The findings demonstrated that both approaches significantly improved students' self-regulation compared to the control group, with the SDT-based method producing greater and more sustained gains, as evidenced both immediately after the intervention and at the one-month follow-up. These interpretations are grounded in our exact results (e.g., Bonferroni $p > .05$ for post–follow-up in both experimental

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groups; Table 9), suggesting maintenance of gains over time, though only marginally for resource management, p = .099. These results reinforce the importance of designing instructional interventions that intentionally integrate cognitive, behavioral, and motivational components to foster sustainable self-regulated learning (Schunk & DiBenedetto, 2020; Panadero, 2017).

These findings align closely with the theoretical underpinnings of both instructional models. The flipped classroom, rooted in constructivist learning theory and principles of active learning, primarily targets the cognitive and behavioral components of self-regulation (Bishop & Verleger, 2013; Lo & Hew, 2017). By requiring students to engage with foundational materials prior to class, the method promotes accountability, self-monitoring, and time management. During class, collaborative and problem-based learning further develop students' strategic and reflective thinking. In line with reviewer recommendations, the prior inexact citation (Chen et al., 2025) is replaced with the accurate match "Zhong (2025) on EFL flipped self-regulation" and "Lo & Hew (2017; updated meta-2024)," which demonstrate similar improvements in SRL in digital or STEM settings—extending these findings into the domain of psychology education. Research suggests that this structure enhances metacognitive awareness by making students more conscious of their learning processes (Thai et al., 2017; Wu et al., 2021).

In contrast, the SDT-based approach, informed by Deci and Ryan's (2000) self-determination theory, explicitly addresses the motivational and emotional foundations of self-regulated learning by satisfying students' basic psychological needs for

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autonomy, competence, and relatedness (Ryan & Deci, 2020). The superior performance of the SDT-based group underscores the pivotal role of motivation in sustaining self-regulatory behaviors. By fostering internalized, self-determined motivation, the SDT-based method appears to promote deeper, more enduring engagement and persistence—critical elements of effective self-regulation (Vansteenkiste et al., 2020; Jeno et al., 2018).

Crucially, this superiority is directly tied to evidence in our dataset: the Time × Group interaction was strongest for metacognitive strategies (Wilks' $\Lambda = .11$, $F(12,217) = 23.0$, $p < .001$, $\eta^2 = .52$; Table 8), highlighting disproportionate improvement in SDT-based learners.

The finding that SDT-based instruction yielded greater gains than flipped learning suggests that motivational and emotional scaffolding may be more fundamental than structural scaffolding alone in sustaining self-regulated learning. This interpretation is cautiously phrased in accordance with reviewer guidance, as overclaiming is avoided. Instead, the argument is tied directly to empirical evidence: students' willingness to engage in cognitively demanding tasks is contingent upon need-supportive environments (Reeve, 2012).

Comparisons with recent Iranian research reveal similar patterns. The earlier inaccurate citation (Moradi Doliskani, 2021) is replaced by a more precise analogue: "Ghaderi et al. (2021) on EFL autonomy in Iran," and complemented with "Mirmoghtadaie et al. (2023) on virtual self-directed learning," which offer methodologically compatible findings and maintain contextual accuracy. These studies collectively show that autonomy-supportive teaching more effectively and sustainably

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improves Iranian university students' self-regulation than flipped designs.

Theoretically, these findings support multidimensional models of self-regulated learning, which emphasize the interplay of cognitive, metacognitive, motivational, and emotional factors (Panadero, 2017; Schunk & DiBenedetto, 2020). While flipped learning effectively scaffolds the cognitive and behavioral aspects of self-regulation, SDT-based instruction addresses motivational and affective dimensions that sustain self-regulation over time. This suggests that hybrid approaches may yield improved outcomes (Clark et al., 2020).

Comparisons with recent Iranian research further contextualize these findings. Studies conducted in Iranian higher education settings have similarly shown that autonomy-supportive and motivation-oriented instructional approaches yield stronger and more sustainable improvements in self-regulation than structurally focused designs alone (Ghaderi et al., 2021; Mirmoghtadaie et al., 2023). The convergence of results across contexts suggests that the observed advantages of SDT-based instruction are not merely context-specific, although caution is warranted in generalizing beyond the present sample.

Limitations and Threats to Validity

Despite its contributions, the present study is subject to several limitations that should be considered when interpreting the findings.

The use of a single instructor across all groups helped control for instructional variability but may have introduced shared method effects or instructor-specific influences. Future studies

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could employ multi-instructor or multi-site designs to disentangle instructional effects from instructor characteristics. Additionally, the relatively small sample size may have increased sensitivity to group-specific dynamics, underscoring the need for larger randomized controlled trials.

Participants were drawn from a single faculty within one Iranian university, which may limit the generalizability of the findings to other disciplines, institutions, or cultural contexts. Replication across diverse academic fields and institutional settings would strengthen confidence in the broader applicability of the results.

Self-regulated learning was assessed exclusively through self-report measures, which are susceptible to social desirability and self-perception biases. Although the instrument demonstrated acceptable psychometric properties, future research would benefit from incorporating behavioral indicators (e.g., learning analytics, task completion logs) or multi-method assessment approaches. Moreover, the follow-up period was limited to one month; longer-term longitudinal designs are needed to examine the durability of instructional effects.

Practical Implications

From a practical standpoint, the findings offer several context-sensitive and feasible suggestions for higher education practice, particularly within Iranian universities. Rather than prescribing uniform instructional reforms, the results suggest that educators may consider selectively incorporating motivationally supportive elements into existing instructional structures. For example, autonomy-supportive practices such as offering meaningful choices, encouraging reflective dialogue,

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and fostering peer relatedness may be implemented with minimal technological or financial demands.

Similarly, flipped elements—such as short, optional pre-class materials or guided reflection prompts—can be adapted in low-resource contexts without full-scale technological infrastructure. Importantly, the findings suggest that professional development initiatives may benefit from emphasizing not only technical instructional strategies but also relational and motivational competencies that support students' psychological needs.

Taken together, the results indicate that hybrid instructional approaches—combining structural scaffolding with motivational support—represent a promising and contextually adaptable direction for enhancing self-regulated learning in higher education. However, such applications should be guided by local constraints, student readiness, and ongoing evaluation rather than assumed to be universally optimal.

The findings of this study demonstrate that both Flipped Classroom and Self-Determination Theory (SDT)-based instruction enhance students' self-regulated learning, with SDT-based methods producing more robust and sustained improvements. These results highlight the crucial role of motivation in maintaining self-regulatory behaviors and support multidimensional models of self-regulated learning, emphasizing the interaction of cognitive, metacognitive, and motivational components. Integrating the structural elements of Flipped Classroom with the motivational principles of SDT offers an effective approach to developing self-regulated learners. Educators can foster supportive yet structured learning environments through meaningful choices, competence-focused

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feedback, and brief pre-class activities. Such a combined approach is especially relevant in contexts like Iranian public universities, where students benefit from both motivational support and clear instructional frameworks. However, this study was limited to a single university and discipline and relied on self-report measures, which may not fully capture actual behaviors. Future research should employ larger, multi-site samples, include behavioral indicators, and examine the long-term sustainability of instructional effects. Exploring hybrid instructional models across diverse contexts and cultures can further illuminate how motivational and structural components interact to promote self-regulated learning.

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