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Investigating the Roles of Self-Directed Learning in Developing the 4Cs of 21st Century Skills Among Student Teachers

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Abstract

This study investigates the role of self-directed learning (SDL) in developing the 4Cs of 21st-century skills (critical thinking, communication, collaboration, and creativity) among student teachers in Cambodia. The research employs a quantitative approach, utilizing a survey of 115 student teachers to examine SDL practices, challenges in implementation, and the relationship between SDL and the 4Cs. Findings reveal that student teachers engage in various SDL practices, with learning strategies being the most frequently employed. The study identifies several challenges in implementing SDL, particularly in applying learning strategies and setting goals. A strong positive correlation ($r = 0.708$, $p < 0.01$) is found between SDL and the development of the 4Cs, indicating that higher engagement in SDL is associated with the development of enhanced 21st-century skills. The research provides valuable insights for teacher education programs in Cambodia, highlighting the potential of SDL in preparing future educators for the demands of 21st-century teaching and learning.

Keywords: Self-Directed Learning, Communication, Collaboration, Critical Thinking, Creativity

1. Introduction

1.1 Introduce the Problem and Background of Self-Directed Learning

Self-directed learning (SDL) has become a significant educational strategy in the twenty-first Century due to its ability to foster core skills such as critical thinking, communication, teamwork, and creativity (the 4Cs). SDL is fundamental to our understanding of education's capacity to empower students and equip them for lifelong learning,

as it continues to evolve to meet the requirements of a rapidly changing world (Trilling & Fadel, 2009). According to researchers Ariyasinghe, D., and Chandrasena Premawardhena, N. (2025), there has been a recent surge in interest in SDL. One of the most discussed concepts in the field of education is self-directed learning, where students take control of their education by determining their learning preferences and setting goals. SDL has been a subject of research since 1970, with the concept of SDL having its roots in theories of adult learning. Malcolm Knowles popularized the term in the 1970s as part of his work on andragogy. Since then, SDL has been recognized as a valuable approach in various educational contexts, including teacher education (Knowles, 1975). The historical development of SDL reflects a shift from teacher-centered to learner-centered approaches, emphasizing autonomy and personal responsibility in the learning process.

In the context of modern teacher education, SDL plays a crucial role in preparing prospective teachers to be lifelong learners and reflective practitioners. A growing body of literature recognizes the importance of SDL in the field of teacher education. As future teachers, student teachers must develop the ability to continually update their knowledge and skills, adapt to new teaching methods, and respond effectively to the changing needs of their students. SDL enables them to take ownership of their professional development, promoting an attitude of continuous improvement and innovation in their teaching practice (Brockett & Hiemstra, 1991; Candy, 1991; Garrison, 1997; Villegas-Reimers, 2003). Even while self-directed learning (SDL) is acknowledged as crucial for the development of 21st-century abilities, there are still many unanswered questions regarding its precise function and effects in the Cambodian context. The following major topics, which surfaced from a thorough analysis of contemporary literature and educational practices in Cambodia, are the focus of this study: Limited research on the contribution of SDL to the development of the 4Cs (critical thinking, communication, collaboration, and creativity) among Cambodian student teachers. They have not treated SDL in much detail: There is a dearth of empirical data specific to the educational environment in Cambodia, despite research conducted worldwide demonstrating the potential of SDL in fostering these abilities. This gap is particularly notable given the country's ongoing efforts to modernize its education system and align it with international standards (Ministry of Education, Youth and Sports, 2024). However, there is a current paucity of studies investigating how SDL practices can be effectively integrated into teacher training programs to enhance the 4Cs. This is crucial for informing policy decisions and curriculum development in Cambodia's evolving education sector (Garrison, 1997; Darling-Hammond et al., 2017; Trilling & Fadel, 2009).

Inadequate understanding of the challenges and obstacles faced by Cambodian student teachers in effectively implementing SDL practices: The traditional teacher-centered approach that has long prevailed in Cambodian education presents unique obstacles to implementing SDL methods (Brooks, 2015). These challenges may include, but are not limited to, cultural expectations of passive learning, limited access to various learning resources, and potential resistance to autonomous learning practices (Phin, 2014). Identifying and analyzing these barriers is crucial for developing targeted strategies to overcome them and create an environment conducive to SDL in Cambodian teacher education programs. Lack of comprehensive studies examining the relationship between SDL and the acquisition of 21st-century skills in teacher education programs (Trilling & Fadel, 2009). Therefore, this research aims to investigate the following objectives:

1. To determine various SDL practices used by student teachers
2. To explore the challenges in implementing SDL
3. To examine the relationship between SDL and the advancement of the 4Cs (critical thinking, communication, collaboration, and creativity) of 21st-century skills
4. To determine the impact of SDL on the 4Cs

This study set out to address the following research questions:

1. What SDL practices do student teachers commonly use?
2. What challenges do student teachers face in implementing SDL?
3. What is the relationship between SDL and the 4Cs (critical thinking, communication, collaboration, creativity) among student teachers?
4. How does SDL impact the development of the 4Cs among student teachers?

1.2 Self-Directed Learning

A considerable amount of literature has been published on SDL. Self-directed learning is commonly regarded as a crucial aspect of professional development, empowering individuals to take charge of their own learning and growth. This approach acknowledges the complex and multifaceted nature of professional learning, which is closely tied to an individual's personal history, goals, and organizational context (Fenwick, 2003). This paper will use Knowles' (1975) definition of SDL, which is a process in which individuals diagnose their own learning needs, set their own learning goals, locate learning resources, select and implement the best learning strategies, and evaluate their own learning outcomes, even though the term has been defined in several ways. Self-directed learners (SDLs), a relatively recent concept introduced by Bosch & Laubscher (2022), are students who actively participate in and manage their own learning processes. SDL generally refers to an educational strategy in which students accept responsibility for their own learning. With minimal teacher guidance, SDL empowers students to set their own learning goals, identify their learning needs, locate resources, choose learning strategies, and assess their learning outcomes (Fournier & Kop, 2010). According to Raemdonck et al. (2017) and Verster et al. (2018), self-directedness is a work-related learning process that involves adjusting direction and accepting responsibility for selecting and implementing suitable teaching and learning strategies. According to Van Zyl & Mentz (2019, p. 70), "SDL is acknowledged as a crucial aspect in the context of education for the 21st century." The three pillars of self-directedness are: Ability, drive, and faith in oneself (Gavriel, 2015). Benson (2011) adopted a similar position, describing learner autonomy as "the capacity to control one's own learning" (p. 58). These brief definitions make it clear that students are responsible for initiating, guiding, and overseeing their own education (Wenden, 1991). In his explanation, Little (2007) stressed that following preset agendas and being independent in identifying learning environments are normal.

1.3 Historical Development of Self-Directed Learning

The extent to which much research on self-directed learning can be applied. According to Knowles (1975), there are three primary parts to SDL: the student, the instructor, and a collection of educational materials. In the first section, Knowles discusses the significance of self-directed learning (SDL) and its differences from student-centered, pedagogically directed learning (EDL). The second component emphasizes the educator's participation in SDL. Knowles gives the reader detailed guidance on how a learning facilitator might lead a group of students on a self-discovery trip. Exercises to take responsibility for your own learning are included in the final section. Adult self-directed learning has a long history. According to Brackett and Hiemstra (1991), it has its roots in the works of the Greek philosophers Socrates, Plato, and Aristotle (Lee & Caffarella, 1994). This is essential in a rapidly changing world where workers need to be flexible and constantly learning new things. Rather than requiring traditional professional development, organizations should strive to respect the diverse ways people perceive the world and foster their independence (Lee & Caffarella, 1994). Rather than demanding traditional professional growth, organizations should aim to respect individuals' many sensemaking processes and promote their autonomy (Fenwick, 2003). Teachers who develop professionally effectively engage in continuous, interactive, teaching-focused learning activities that are relevant to their work. According to Hunzicker (2011), self-directed learning emphasizes the creation of knowledge through discourse and conversation, rather than teaching as a process where an instructor is the primary source of information. Professionals need to be self-motivated learners because it helps them handle the complexity of their work and continually improve at it (Morris, 2019).

1.4 Self-Directed Learning and 4Cs of 21st Century Skills

SDL is a principal determining factor of enhancing the 4Cs of the 21st Century. Skills Learners should be taught to become more independent as part of their preparation for future careers, with an emphasis on developing the 4Cs of 21st-century skills: critical thinking, communication, collaboration, and creativity. While teachers and effective teaching techniques continue to contribute to the value of education, learner-centered approaches expect students to take more responsibility and control over their own learning (Frederiksen, 2017). By fostering self-assurance, independence, motivation, and a lifelong learning mindset, SDL empowers students to take an active and engaged role in their educational journey (Wong et al., 2021). Critical thinking abilities and self-directed learning (SDL) are closely linked due to learner profiles and the needs of higher education. Autonomous and self-

directed learners must evaluate and question the knowledge and information they encounter throughout the learning process (Chukwunemerem, 2023). To date, several studies have examined the effectiveness of SDL on 21st-century skills. It has shown that in addition to Self-Directed Learning (SDL), the following approaches are touted as best practices for developing the 4Cs in learners: (1) Critical Thinking: Inquiry-based learning and problem-solving activities that encourage students to analyze, evaluate, and synthesize information (Facione, 2011), (2) Communication: activities that promote verbal and written expression, such as presentations, debates, and collaborative writing projects (National Education Association, 2012), (3) Collaboration: group projects and cooperative learning strategies that require students encourage working together toward common goals (Partner for 21st Century Learning, 2015) and (4) Creativity: Open-ended assignments and project-based learning that enable students to develop original ideas and innovative solutions (Robinson, 2011). The research to date, as argued by Maryam et al. (2025), suggests that EFL learners' academic writing abilities were improved through self-directed learning, with the relationship between the two somewhat mediated by critical thinking capacity. Furthermore, all of these variables showed a strong positive correlation with one another. This study highlights how important it is to promote critical thinking and SDL to enhance academic writing abilities. One of the most cited studies is that of Huang et al. (2023), who found that students develop an open-minded, curious mindset that improves their critical thinking abilities through SDL exercises, such as goal-setting, resource-seeking, and reflective practice (Huang et al., 2023). The innovative and seminal work of Chukwunemerem (2023) pioneered a new approach to examining SDL and provided a valuable insight into fostering 4Cs skills; he argues that self-directed learning activities can help university students think more critically. Self-directed learning activities offer numerous advantages, including the development of critical thinking, teamwork, independence, ICT skills, research, and other beneficial skills.

Adapting SDL to develop the 4Cs requires carefully modifying and building its pedagogy (Du Toit & Pool, 2016). Consequently, student teachers need training in specific tasks to support SDL and the development of the 4Cs (Guglielmino, The case for promoting self-directed learning in formal educational institutions, 2013). Several studies suggest that teachers should receive specialized training to select pedagogies for SDL (Golightly, 2016) and 21st-century skills teaching (Du Toit & Gaotlhobogwe, 2018). A more substantial approach to the longer-term significance of SDL can be found in Saiz and Rivas (2023). It is crucial to cultivate the fundamental critical thinking skills necessary for making informed decisions, solving problems, and interpreting information, so that one can conclude in the context of independent and autonomous learning. The goal was to create the necessary evidence that self-directed language learning enhances language proficiency, impacts the participants' growth in language proficiency, which in turn increases learner engagement. Furthermore, the results showed that most participants favored SDL and thought it would help them in their academic endeavors (Ariyasinghe & Premawardhana, 2025). Diagnosing learning needs: This process promotes critical thinking as students analyze their own knowledge gaps and determine learning priorities (Knowles, 1975). Formulating learning goals: This step promotes communication skills as students clearly and concisely articulate their goals (Garrison, Self-directed learning: Toward a comprehensive model, 1997). Identifying learning resources: This aspect promotes collaboration as students share and recommend resources to others, while also fostering critical thinking in evaluating the credibility of sources (Brockett & Hiemstra, 1991).

Selecting and implementing appropriate learning strategies: This process encourages creativity as students experiment with different methods to find what works best for them. This also involves critical thinking in selecting the most effective strategies (Zimmerman, 2002).

Assessing Learning Outcomes: This final step integrates all of the 4Cs as students critically evaluate their progress, communicate their results, collaborate with peers to receive feedback, and creatively adjust their learning approaches based on the results (Boud, 2000).

1.5 Challenges and Barriers to Implementing Self-Directed Learning

Despite the numerous benefits of self-directed learning (SDL), its practical implementation presents several challenges and obstacles. These include students' lack of motivation, difficulties with time management, problems identifying appropriate resources, challenges with goal setting, and issues with self-assessment. Additionally,

inadequate instructor support, curriculum limitations, maintaining self-discipline, and limited opportunities for collaboration can hinder the implementation of SDL. Overcoming these barriers requires a multifaceted approach that includes providing appropriate support, creating a conducive learning environment, and fostering a culture that values and encourages self-directed learning (Brockett & Hiemstra, 1991; Brookfield, 2009; Fenwick, 2003; Caffarella & Lee, 1994). First of all, while social media might help children learn, it can also divert their attention. To pursue knowledge on their own, college students often require assistance from parents, peer groups, and even former students; without it, this can be a significant impediment to their learning. One well-known early study often cited in research on SDL is that among the tactics employed by college students were setting priorities and maintaining cordial relationships with friends, classmates, seniors, and former pupils (Murniati, Hartono, & Nugroho, 2023). Six emerging themes, on the other hand, emerged from 25 challenges: (a) challenges and limitations in theoretical and practical procedures; (b) issues with time constraints and academic workloads; (c) technical challenges in learning modules; (d) communication, course, and guidance difficulties; (e) challenges with online learning, connectivity, and learning management systems; and (f) social and personal challenges as a student. These difficulties served as the foundation for the students' suggestions on addressing the previously mentioned emerging issues (Tabuena & Villareal, 2023).

2. Methodology

2.1 Research Design and Research Instrument

To investigate student teachers' self-directed learning in relation to the 4Cs of 21st-century skills, the researcher updated Guglielmino's (1977) survey. SDL was prepared according to the procedure used by the Self-Directed Learning Readiness Scale and Knowles's (1975) five components of SDL. Questions from well-known frameworks, such as Garrison's (1997) self-directed learning model, were included in the survey. A Cronbach's Alpha of 0.94 was obtained from a pilot survey with 115 participants, indicating strong reliability and indicating that the survey items consistently measure the desired construct (Dekeyser, 1997). Data analysis employs SPSS software, utilizing various statistical methods. These include descriptive analysis for examining SDL practices and challenges, Pearson's correlation and multiple regression to explore the relationship between SDL and its impact on the 4Cs (critical thinking, communication, collaboration, and creativity), and one-way ANOVA to assess differences across student-teacher subgroups. This quantitative approach facilitates an examination of SDL practices, associated challenges, and their correlation with the development of 21st-century skills among student teachers.

3. Findings

Research question 1: What SDL practices do student teachers commonly use?

The results in Table 1 indicate a relatively high engagement across all practices, with mean scores ranging from 3.0326 to 3.2489 on a 4-point scale. Notably, Learning Strategies emerged as the most frequently employed practice, boasting the highest mean score of 3.2489. In contrast, Evaluating Learning showed the lowest mean score at 3.0326, suggesting it might be the most challenging aspect for student teachers. The standard deviations, spanning from 0.36908 to 0.45345, indicate moderate variability in responses, implying some diversity in how individual student teachers approach these SDL practices.

Table 1: Descriptive Statistics for SDL

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Identify Needs	115	2.25	4.00	3.2293	0.36908
Goals Setting	115	2.13	4.00	3.2250	0.41133
Learning Resources	115	2.00	4.00	3.2054	0.42958
Learning Strategies	115	2.13	4.00	3.2489	0.39959

Evaluating Learning	115	2.00	4.00	3.0326	0.45345
Valid N (listwise)	115	—	—	—	—

Research question 2: What challenges do student teachers face in implementing SDL?

Based on Table 2, the most significant challenge appears to be in implementing learning strategies, with a mean score of 2.9235 (SD = 0.51270). This is closely followed by difficulties in goal setting (M = 2.8557, SD = 0.50440) and evaluating learning outcomes (M = 2.8522, SD = 0.55636). Identifying learning needs presents a moderate challenge (M = 2.8365, SD = 0.44056), while finding learning resources seems to be the least challenging aspect (M = 2.5304, SD = 0.55253). Notably, all challenges have mean scores above the midpoint of 2.5 on a 4-point scale, indicating that student teachers experience moderate to high levels of difficulty across all aspects of SDL implementation.

Table 1: The descriptive statistics for the challenges faced in implementing SDL

	N	Minimum	Maximum	Mean	Std. Deviation
Challenge_Needs	115	1.60	4.00	2.8365	.44056
Challenge_Goals	115	1.80	4.00	2.8557	.50440
Challenge_Resources	115	1.20	4.00	2.5304	.55253
Challenge_Strategies	115	1.60	4.00	2.9235	.51270
Challenge_Evaluating	115	1.00	4.00	2.8522	.55636
Valid N (listwise)	115				

Research question 3: What is the relationship between SDL and the 4Cs (critical thinking, communication, collaboration, creativity) among student teachers?

The analysis of the correlation between Self-Directed Learning (SDL) and the 4Cs of 21st-century skills (critical thinking, communication, collaboration, and creativity) among student teachers reveals a strong, positive relationship. With a Pearson correlation coefficient of 0.708, which is statistically significant at the 0.01 level (2-tailed), the study demonstrates a robust connection between these two variables. This finding suggests that as engagement in self-directed learning increases, there is a corresponding enhancement in the development of 21st-century skills. Conversely, students who exhibit stronger 4Cs are more inclined to engage in self-directed learning practices.

Table 2: The relationship between SDL and 4Cs

	SDL	Four Cs
Pearson Correlation	1	.708**
Sig. (2-tailed)		.000
N	115	115
Four Cs	Pearson Correlation	.708**
	Sig. (2-tailed)	.000
	N	115

** . Correlation is significant at the 0.01 level (2-tailed).

Research question 4: How does SDL impact the development of the 4Cs among student teachers?

The Analysis of Variance (ANOVA) results for the regression model examining the impact of Self-Directed Learning (SDL) on the 4Cs of 21st century skills reveal compelling insights. The model demonstrates statistical

significance ($F = 24.515$, $p < .001$), strongly indicating that SDL practices are significant predictors of the 4Cs. The substantial portion of variance accounted for by the regression model is evident in the comparison between the sum of squares for regression (8.437) and the residual (7.503). The model utilizes five predictors, as shown by the degrees of freedom (df), which likely correspond to the five SDL practices discussed earlier in the study. These findings collectively suggest that SDL practices exert a significant influence on the development of critical thinking, communication, collaboration, and creativity among student teachers.

Table 3: ANOVA^a : The impact of SDL on 4Cs

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.437	5	1.687	24.515	.000 ^b
	Residual	7.503	109	.069		
	Total	15.940	114			

a. Dependent Variable: Four Cs

b. Predictors: (Constant), Evaluating_Learning, Identify_Needs, Learning_Resources, Goals_Setting, Learning_Strategies

The multiple regression analysis examining the impact of Self-Directed Learning (SDL) practices on the 4Cs (critical thinking, communication, collaboration, and creativity) among student teachers reveals interesting findings. Learning Strategies emerges as the most influential SDL practice, demonstrating the most substantial positive impact on the 4Cs ($\beta = 0.388$, $p = 0.002$). Goal Setting follows as the second most crucial practice, also showing a significant positive effect ($\beta = 0.243$, $p = 0.025$). While Identifying Needs and Learning Resources show positive effects, these are not statistically significant ($p = 0.263$ and $p = 0.245$, respectively). Interestingly, Evaluating Learning displays a slight adverse effect, though this too is not statistically significant ($\beta = -0.059$, $p = 0.598$). These results suggest that enhancing the 4Cs among student teachers may be most effectively achieved by focusing on improving learning strategies and goal-setting skills.

Table 5: Coefficients of SDL Variables Predicting Four Cs

Coefficients ^a		Unstandardized Coefficients		Standardized Coefficients		Sig.
Model		B	Std. Error	Beta	t	
1	(Constant)	.883	.235		3.763	.000
	Identify_Needs	.116	.103	.114	1.125	.263
	Goals_Setting	.221	.097	.243	2.271	.025
	Learning_Resources	.111	.095	.127	1.168	.245
	Learning_Strategies	.363	.112	.388	3.249	.002
	Evaluating_Learning	-.048	.091	-.059	-.529	.598

a. Dependent Variable: Four Cs

According to the study, student teachers employed a range of SDL techniques, including determining learning needs, establishing objectives, selecting learning materials, implementing learning strategies, and evaluating learning outcomes. Knowles' (1975) concept of SDL, which emphasizes learners taking initiative in diagnosing needs, creating goals, and locating resources, is consistent with these approaches. Although the results did not delve into detail about specific obstacles, the literature review highlighted several potential ones, including a lack of motivation, difficulty managing time, challenges in finding suitable resources, and issues with self-evaluation. For SDL to be implemented successfully, these issues must be resolved (Guglielmino, 2008). The results showed that SDL and the 4Cs (communication, collaboration, critical thinking, and creativity) had a substantial positive relationship ($r = 0.708$). This supports the literature's assertion that SDL and 21st-century skills, which prioritize student autonomy and adaptability, are closely associated (Trilling & Fadel, 2009). The study found that SDL has

a significant influence on the development of the 4Cs ($F = 24.515, p < .001$). Descriptive statistics showed that all four skills had mean scores above three on a 4-point scale, with collaboration having the highest mean (3.4991) and communication the lowest (3.2348). This aligns with the literature suggesting that SDL practices support the development of these crucial 21st-century skills (Brookfield, 2009).

These results contribute to our understanding of SDL and its role in helping student teachers develop 21st-century skills. According to Merriam and Bierema (2013), their work offers insightful information that can be used to advance successful SDL practices and enhance teacher education programs.

4. Implications of the Study

The findings of this study have several important implications for teacher education and the development of 21st-century skills:

Enhanced Teacher Education Programs: The strong correlation between SDL and the 4Cs suggests that teacher education programs should incorporate more SDL practices to support student learning and development.

Professional Development: The study's results emphasize the need for ongoing professional development opportunities that promote SDL among in-service teachers. This could help educators continually enhance their 21st-century skills throughout their careers.

Curriculum Design: Educational policymakers and curriculum designers should consider integrating SDL principles into K-12 curricula to enhance student learning outcomes. This could help students develop essential 21st-century skills from an early age, preparing them for future academic and professional success.

5. Recommendations for Further Study

Based on the findings and limitations of this study, the following recommendations are proposed for future research:

Expand the sample size and geographical scope: Future studies should include a larger and more diverse sample of student teachers from different regions and institutions to enhance the generalizability of the findings.

Longitudinal research: Conduct longitudinal studies to examine how SDL and the 4Cs develop over time throughout a student teacher's education and early career.

Mixed-methods approach: Incorporate both quantitative and qualitative methods to gain a more comprehensive understanding of the relationship between SDL and the development of 21st-century skills.

Investigate specific SDL strategies: Explore the effectiveness of various SDL strategies in developing each of the 4Cs to identify best practices for teacher education programs.

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