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Mixed Methods Article

# Development of Future Skills Assessment Criteria for Undergraduate Students in Cambodia: Mixed Methods Research

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## Abstract

**Background and Problem:** Cambodian students face challenges due to a lack of essential skills for future job demands, which stems from limited access to modern educational resources and a mismatch between current curricula and evolving global skill requirements. However, research studies on this issue remain limited.

**Objective/ purpose:** This study aims to: 1) analyze and validate a future skills model using multilevel confirmatory factor analysis (MCFA); and 2) develop future skills assessment criteria for Cambodian undergraduate students.

**Design and Methodology:** A mixed-method multilevel explanatory sequential design was employed in two phases. Quantitative data were collected from 400 Cambodian students across 50 majors using multistage random sampling. Qualitative data were gathered through in-depth interviews with seven key informants. Data analysis involved MCFA for quantitative data and content analysis for qualitative data.

**Results:** The MCFA revealed three main components of future skills: learning and innovation skills, information, media and technology skills, and life and career skills ($\chi^2$= 83.96, df = 78, RMSEA= .01, CFI = 1.00, TLI = .98, $SRMR_W$ = .02, $SRMR_B$ = .08). At both the student and major levels, life and career skills emerged as the most significant factor, which aligns with key informants' opinions. The study developed 86 indicators and 102 assessment criteria across three main components, based on both quantitative and qualitative data.

**Conclusion and Implications:** The study's results can be used as guidelines to improve curricula, teaching methods, and assessments of future skills for undergraduate students, helping them to be well prepared for their future careers.

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**Keywords**

Future skills assessment criteria, learning and innovation skills, information media and technology skills, life and career skills, multilevel explanatory sequential design.

**Originality/Value for the Sustainable Development Goals (SDGs)**

This research on future skills and assessment criteria illuminates competencies needed for rapid technological and social changes. It informs educational interventions promoting lifelong learning and workforce readiness. By integrating critical skills into curricula, the study aligns with future workforce demands, contributing to SDG-4 (quality education) and SDG-8 (decent work and economic growth). The resulting framework guides educators and policymakers in bridging the gap between academic preparation and evolving workforce needs in Cambodia, equipping undergraduates for 21st century workplace challenges.

Proficiency in many skills is essential for individuals to lead fulfilling lives and operate effectively in modern society. In educational settings, students must develop blend of interpersonal and technical skills in order to attain success. They need to excel in their learning and apply their acquired knowledge

proficiently. To effectively utilize their technical strengths in professional environments, individuals must also exhibit exceptional interpersonal skills (Organisation for Economic Co-operation and Development [OECD], 2018; World Economic Forum, 2020). Successful collaboration and interpersonal connections need the existence of crucial interpersonal skills. Patacsil and Tablatin (2017) highlights the significance of soft skills, such as teamwork and communication skills, for graduate students. Both soft and hard skills are vital for students to thrive in the competitive industrial landscape. However, they can also be linked to disengagement in behavior (Palardy & Rumberger, 2019).

In Cambodia, where there is a growing need for technological advancement and educational restructuring, the emphasis on future skills is particularly urgent, because Cambodia now experiencing a shortage of technology, which required improvements in the nation's education system (Phnom Penh Post, 2018). Future skills—encompassing learning and innovation skills, information, media, and technology skills, as well as life and career skills (Partnership for 21st Century Skills, 2009; Tem et al., 2022). Despite the significance of future talents, universities typically focus primarily on providing basic education and neglect the specific skills that are becoming increasingly crucial in quickly changing labor markets. While technological shortages present challenges, the evolving nature of work also highlights the increasing importance of soft skills. These skills offer significant advantages in the modern workplace (Tem et al., 2022). As industries adapt to technological changes, employees with strong soft skills are better equipped to navigate these transitions and contribute effectively to their organizations (Sarik, 2024). In addition, Cambodian university students, particularly those from provincial areas, encounter various obstacles, including restricted availability of educational resources and opportunities, as well as insufficient chances to acquire practical knowledge and skills essential for the labor market (Heng, 2024). The World Bank has identified two essential skills areas necessary to fulfill Cambodia's labor requirements. The first category refers to technical skills, also referred as hard skills, which are precise technical abilities required for tasks or activities in successful businesses such as textiles, tourism, and construction, but excluding agriculture. The remaining skills encompass cognitive talents and behavioral competencies, such as resilience, self-control, teamwork, conflict resolution, risk assessment, effective communication, dedication, decision-making, problem-solving, and inner motivation (Em et al., 2023; Rigolini et al., 2010). Hence, it is crucial to have a comprehensive comprehension of the future skills evaluation of undergraduate students.

In Cambodia, there is a significant gap in research regarding students' development of future skills such as technology skills, critical thinking, collaboration, conflict resolution, risk assessment, effective communication, decision-making, problem-solving, and self-motivation. While much attention has been given to general education, studies addressing these specific competencies remain limited, highlighting the need for further exploration and reform in educational strategies to align with the demands on the 21$^{st}$ century workforce (UNICEF, 2022). Conducting study on the evaluation criteria for future talents is crucial, as these abilities are vital for learners, teachers, employees, employers, directors, managers, and leaders. The study on assessment criteria for future skills in undergraduate students will provide significant benefits for curriculum developers, universities, and policymakers. It will offer them a precise assessment of the competency level of undergraduate students in future abilities. In addition, this study utilized multilevel confirmatory factor analysis (MCFA) to examine the data that included numerous levels of nested structure, such as students inside a classroom, classrooms within a school, and so on. The variation of a variable can be decomposed into two components: within-group and between-group. This decomposition helps to better comprehend the origins of variance and, more importantly, minimizes estimation mistakes (Hox et al., 2018; Makmee, 2023; Muthén & Muthén, 2015). Therefore, this study aimed to: 1) analyze the future skills model using multilevel confirmatory factor analysis (MCFA) and test its construct validity; and 2) develop future skills assessment criteria for undergraduate students.

## Literature Review

Globalization and the new technological advancement have altered how people perform their jobs or interact with others. Due to the rapid growth of society and technology, numerous studies have focused on developing future skills, also known as 21st century skills, which are considered fundamental skills for study (Makmee, 2023). Partnership for 21st Century Skills (2009), and Trilling and Fadel (2009) which encompass three main factors: learning and innovation skills; information, media, and technology skills; and life and career skills, among eleven other components. Cambodia's educational system is currently undergoing significant change. Young Cambodians are navigating a rapidly evolving world that demands the development of 21st century skills such as technological proficiency, creativity, critical thinking, media literacy, and effective communication (UNICEF, 2022).

### Learning and Innovation Skills

Learning and innovation skills (LI) are crucial competencies for navigating the rapidly evolving workplace of the future. These skills enable individuals to adapt to change, create novel solutions, and drive progress in various fields. Specifically, LI refers to the ability to perform tasks or create products effectively and efficiently by employing new methods or procedures, such as innovative ideas or cutting-edge techniques. As workplaces become increasingly dynamic, professionals who can continuously learn and innovate are better positioned to solve complex problems and contribute meaningfully to their organizations (Khongcharoen, 2021; Makmee, 2021). As industries and workplaces evolve, particularly with advances in technology, innovation and critical thinking become increasingly important for driving growth, improving processes, and retaining competitiveness. Learning and innovation (LI) skills allow individuals to not only acquire new knowledge but also apply it in creative ways to develop new solutions, products, and ideas, a key trait in the rapidly changing global economy (OECD, 2018; World Economic Forum, 2020). Learning and innovation skills consists of three components: creativity and innovation skills (CI), critical thinking and problem-solving skills (CP), and communication and collaboration skills (CC). The CI is a critical component of work, learning, and daily living. Creative innovation refers to the process of systematically improving or combining existing ideas, products, or processes in novel ways to create significantly enhanced or entirely new solutions that add unique value from the outset, leading to improved change (O'Hara, 2017). Critical thinking and problem-solving skills (CP) are essential for effective logical reasoning, acquiring thorough understanding of problems, and conducting adequate analysis to generate various solutions to challenges (Hitchcock, 2018). Furthermore, CC play a crucial role in one's ability to communicate their viewpoints and ideas effectively and efficiently to others using a variety of tools, as well as in their ability to collaborate with others to achieve shared goals. Communication is a necessary skill for students to collaborate with others and build networks of ideas (Ferres, 2017).

### Information, Media, and Technology Skills

Information, media, and technology skills (IMT) are critical for skills development because they serve as core tools for navigating the digital age and modern workforce. As industries throughout the world constantly expand due to technological advancements, individuals need these skills to effectively access, analyze, and utilize information, communicate through digital platforms, and adapt to new technological tools (OECD, 2018; UNESCO, 2019; World Economic Forum, 2020). Information, media, and technology skills (IMT) encompass the capacity to comprehend, oversee, and utilize information from diverse sources in an ethical manner (Finch et al., 2013; Tem et al., 2022). These skills comprise three components: information literacy, media literacy, and information, communication, and technology skills. Information and communication technologies hinders social integration and personal growth but improves the effectiveness of social connectivity. Information, communication and technology skills (ICT) are a crucial component of IMT for students (Finch et al., 2013; Hu et al., 2018). This enables students to effectively retrieve information, ethically utilize and convey it, critically assess its accuracy, and proficiently apply it to problem-solving or data management from many sources. Information literacy skills (IL) also encompass a fundamental understanding of the ethical and legal considerations related to information access and use (Finch et al., 2013). Media literacy (ML) encompasses the aptitude to utilize various technological

platforms for the purpose of accessing, evaluating, generating, and scrutinizing information (Muensriphum et al., 2021).

**Life and Career Skills**

Life and career skills (LC) refers to a set of skills that enable individuals to successfully handle personal and professional challenges effectively and thrive in today's fast-changing environments (World Economic Forum, 2020). Life and career skills encompass of five distinct categories: leadership and responsibility skills (LR), initiative and self-direction skills (IS), social and cross-cultural skills (SC), productivity and accountability skills (PA), and flexibility and adaptability skills (FA) (Makmee, 2023; Trilling & Fadel, 2009). Learners can more effectively manage their personal and professional lives in the global market with the use of LC skills. According to the World Economic Forum (2020), adaptability has become one of the most in-demand skills, with employers increasingly seeking workers capable of adjusting to varying challenges, while productivity and accountability skills is the key drivers for organizational success. In addition, self-directed learning encourages lifelong learning habits, which are crucial for adapting to evolving job roles and technologies (OECD, 2018). Apart from cognitive capabilities and subject-matter knowledge, students also need to acquire appropriate emotional intelligence. This helps students interact and cooperate with colleagues to accomplish goals, as well as adapt to increasingly demanding work settings, heavy workloads, and approaching deadlines (Chu et al., 2017).

The literature on future skills assessment criteria reveals a growing recognition of the need to align educational and training systems with rapidly evolving global demands. Makmee (2021) and studies on future skills for students in industry in the Eastern Special Development Zone of Thailand (Makmee, 2023; Muensriphum et al., 2021) emphasize that traditional assessment frameworks are increasingly inadequate for preparing students for future challenges due to their focus on current competencies rather than future-oriented skills (Partnership for 21st Century Skills, 2009; Trilling & Fadel, 2009). Despite various efforts to adapt educational practices, there remains a significant disconnect between the skills taught in schools, the skills required by employers in Cambodia, and the skills assessment mechanisms. This gap underscores the necessity for research that not only updates assessment criteria to include future skills but also ensures that these criteria effectively prepare students for the evolving demands of the global job market. By addressing this gap, it is possible to gain a better knowledge of how to connect assessment procedures with future skill requirements. This will help us develop more successful educational programs and policies.

**Research Variables**

In summary, the studied variables consist of 3 main components with 11 sub-components**:** 1) Learning and innovation skills (LI): creativity and innovation skills, critical thinking and problem-solving skills, and communication and collaboration skills 2) Information, media, and technology skills (IMT): information literacy skills (IL), media literacy skills (ML), and information, communication and technology skills (ICT); and 3) Life and career skills (LC): flexibility and adaptability skills (FA), initiative and self-direction skills (IS), social and cross-cultural skills (SC); productivity and accountability skills (PA); leadership and responsibility skills (LR)

**Research Objectives**

There are two research phases and two objectives:

1) To analyze a multilevel confirmatory factor analysis (MCFA) model and test the construct validity of MCFA of future skills among undergraduate students using empirical data.

2) To develop future skills assessment criteria for Cambodian undergraduate students.

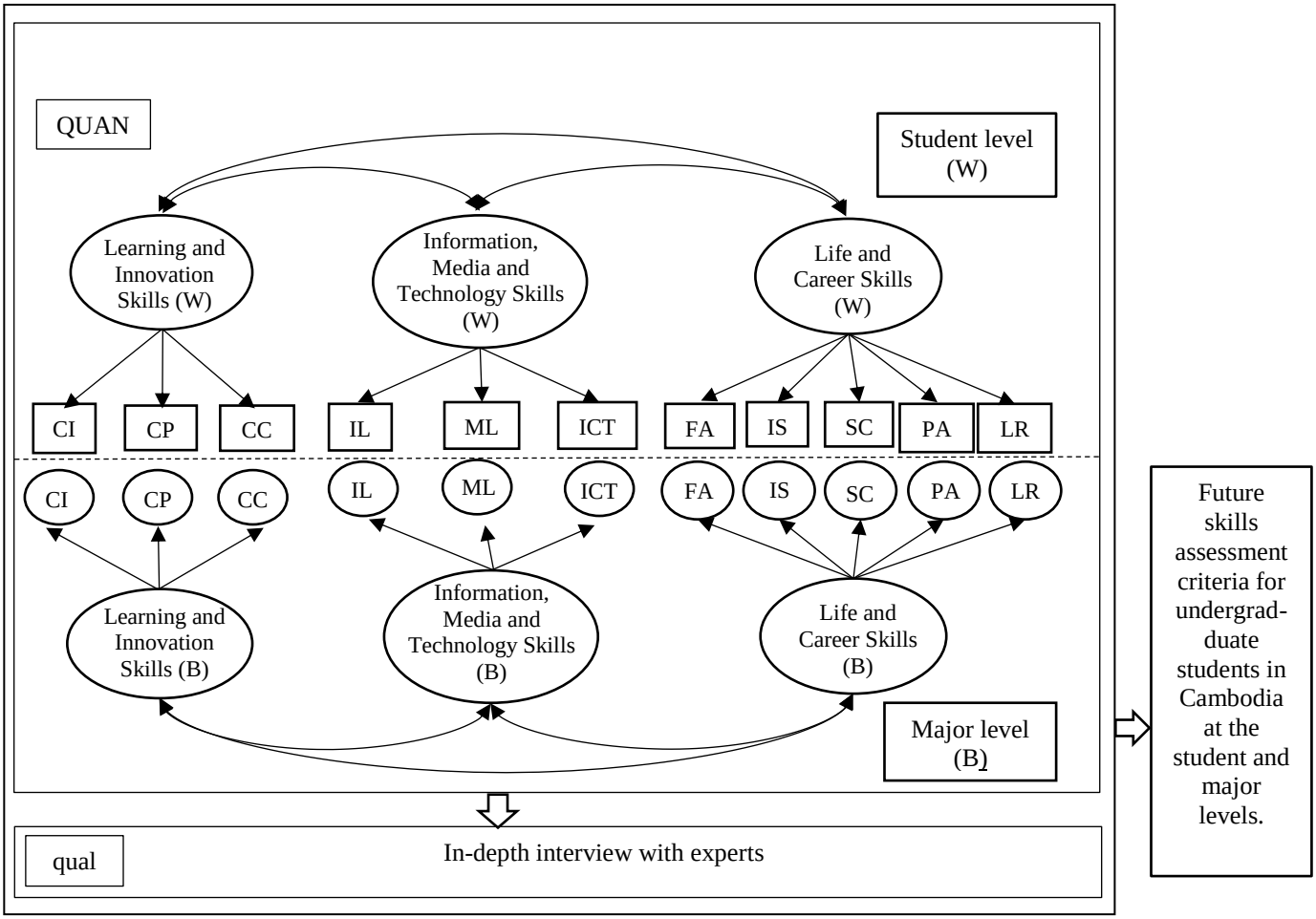
There were two hypotheses for this research as shown in Figure 1.

H1: The multilevel confirmatory factor analysis of future skills for Cambodian undergraduate students, conducted at both student and major levels, will be consistent with the empirical data.

H2: Future skills assessment criteria for undergraduate students in Cambodia at both the student and major levels are suitable.

**Figure 1**

*Conceptual Framework*




*Note*. Creativity and Innovation skills (CI); Critical thinking and Problem-solving skills (CP); Communication and Collaboration skills (CC); Information Literacy skills (IL); Media Literacy skills (ML); Information, Communication and Technology skills (ICT); Flexibility and Adaptability skills (FA); Initiative and Self-direction skills (IS); Social and Cross-cultural skills (SC); Productivity and Accountability skills (PA); Leadership and Responsibility skills (LR), W: Student level, B: Major level.

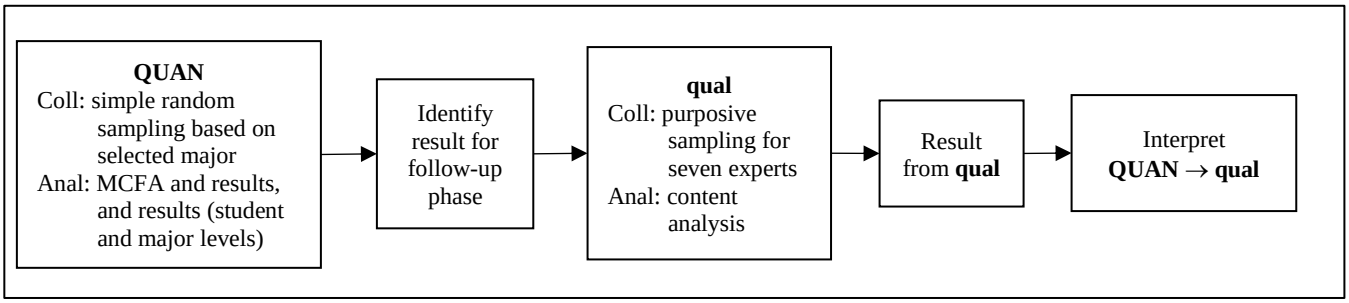
## Methods

### Design

The researchers used mixed methods research: multilevel explanatory sequential design (Edmonds & Kennedy, 2017, p. 197) at both student and major levels. The research design is illustrated in Figure 2.

**Figure 2**

*Design of the Research (Multilevel Explanatory Sequential Design)*




*Note*. Coll = Data Collection, Anal = Data Analysis, QUAN = Quantitative research, qual = Qualitative research.

## Setting

This research study focused on undergraduate students in Cambodia, involving a systematic selection process to ensure representative sampling across 50 majors of study. The researchers initially grouped similar majors offered across multiple universities and then randomly selected one university from each group. This process was repeated for all majors available at more than one university. For majors offered at only a single university, these were combined with the previously selected majors, and then a final random selection of 50 majors was made. The study was conducted from May 4 to July 25, 2019.

## Quantitative Phase

Future skills measurement model at both the student and major levels, comprising three factors: learning and innovation skills, information skills, media and technology skills, and life and career skills, were studied.

### *Population and Sample*

The study's population consisted of undergraduate students pursuing a bachelor's degree in Cambodia. According to Hair et al. (2019) and Hox et al. (2018), the sample size should be 10–20 times the observable variables (components) for factor analysis design. The recommended MCFA was a minimum of 20 groups, while 50 groups were considered perfectly suitable (Em et al., 2023). 50 groups were randomly selected out of 86 majors taught in Cambodia. Multi-stage random sampling was employed in this research study. 50 majors out of 86 majors taught in Cambodia were randomly selected. The researchers then used simple random sampling technique to select students based on the selected majors by selecting 8 students for each major (50 majors * 8 = 400).

### *Research Instruments*

A questionnaire consisting of 55 items and a rating scale based on the future skills model of Boun et al. (2021); Makmee (2023); Partnership for 21st Century Skills (2009); and Trilling and Fadel (2009) was developed and was written in Khmer language. The questionnaire underwent review and approval by three selected experts using the content validity index (CVI), with the item-level CVI (I-CVI) for all items being 1.00. According to Muensriphum et al. (2021) and Polit and Beck (2017) the I-CVI equal 1.00 indicates that all the items can be used in the questionnaire. The rating scale adopted a 5-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (5). The scale exhibited a Cronbach's alpha of .98.

### *Data Collection*

Following approval, the researchers contacted lecturers responsible for teaching the students who were the participants of the research, and together, they scheduled the data collection period. The researchers then introduced and explained the objectives and benefits of the research to the participants, as well as the option to withdraw from participation at any time. Upon completion of the questionnaire, the researchers carefully reviewed each questionnaire to ensure all items had been answered. Data collection took place between 4$^{th}$ to 31$^{st}$ May 2019. The process involved collecting data with the multilevel of information (students and majors' level).

### *Data Analysis*

Multilevel confirmatory factor analysis (MCFA) using Mplus 8.8 was utilized with model fit criteria of CFI and TLI scores were close to 1 and RMSEA scores greater than .07 (Hair et al., 2019). After conducting MCFA and qualitative research, assessment criteria were employed. Calculation of criterion scores is accomplished by the following equation:

$$\sum_{(i=1,n)}(W_iIS_i) = W_1IS_1 + W_2IS_{2+}W_3IS_3 \quad \text{(Formula 1)}$$

S means the sum of three factors assessment score
N means the number of factors (three factors)
W means weighted factor

IS means indicator score

$$\text{Score level} = \frac{\text{Highest score} - \text{lowest score}}{\text{Score range}}$$

**Qualitative Phase**

This phase aimed to validate the findings from the quantitative phase and develop assessment criteria of future skill among students. During the in-depth interviews, assessment criteria for evaluating students' future skills was developed.

***Key Informants***

Creswell and Poth (2018) suggest that in-depth interviews in qualitative research should consist of approximately 5–25 informants, with the ideal number depending on the nature of the study and the point of data saturation. Therefore, in-depth interviews were conducted with seven key informants selected by purposive sampling, all of whom were required to have at least 10 years of teaching experience, hold a master's degree or higher, and serve as student mentors in general knowledge courses.

***Research Instruments***

The result from quantitative research was used to develop a draft future skills assessment criterion. Semi-structured format for in-depth interviews and assessment criteria evaluation form were employed for in-depth interview with seven key informants to evaluate the appropriateness of draft assessment criteria. The sample of in-depth interview as: "Are you in agreement with the three factors pertaining to future skills and their subcomponents? Please evaluate the assessment criteria and prioritize the importance of each skill of the future, both student and major levels?" The three experts deemed this in-depth interview and evaluation form as the suitable instrument (Creswell & Poth, 2018) for conducting interviews with key informants in the subsequent phase.

***Data Collection***

The researcher reached out to the seven key informants, requested an interview with an explanation about these research objectives, and proceeded to schedule it once they agreed. The researcher conducted both face-to-face and online interviews, depending on the convenience of the key informants. Data collection took place between 1st to 25th July 2019.

***Data Analysis***

The content analysis of in-depth interviews was deployed for data analysis (Creswell & Poth, 2018).

## Results

The results of this study, are presented in two phases, quantitative and qualitative.

**Quantitative Phase**

In the quantitative phase, online questionnaires were distributed to all participants. The majority of respondents were female students (61.25%), 21 years old (23.50%), followed by 20 years old (20.25%), and primarily third- year students (40.50%), mostly were third-year students (40.50%), followed by freshman (23.75). Future skills measured by three factors which ordered from highest to the lowest mean scores as follows: Life and career skills (LC) ($M$ = 3.86, $SD$ = .49), Learning and innovation skills (LI) ($M$ = 3.84, $SD$ = .46), and Information, media, and technology skills (IMT) ($M$ = 3.75, $SD$ = .55). It was found that all three factors of future skills had the intraclass correlation (ICC) between .09 – .15 whose values were greater than .05 (Hox et al., 2018), indicating that the data at the student level have variation at the

major level. Thus, multilevel analysis should be performed. Table 1 shows the MCFA model's detailed results for future skills.

**Table 1**
*Results of MCFA of Future Skills*

| Future skills | The result | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Student level (Within) ($n$ = 400 students) | | | | Major level (Between) ($n$ = 50 majors) | | | | |
| | β | *SE* | *t* | $R^2$ | β | *SE* | *t* | $R^2$ | ICC |
| LI | .87 | .02 | 35.13** | .76 | .97 | .01 | 95.64** | .93 | .15 |
| IMT | .79 | .03 | 23.17** | .63 | .44 | .06 | 7.80** | .19 | .11 |
| LC | .89 | .02 | 37.70** | .79 | .98 | .01 | 126.64** | .96 | .09 |
| $\chi^2$ = 4.69, df = 4, $\chi^2$ /*df* = 1.17, RMSEA = .02, CFI = 1.00, TLI = .99, $SRMR_W$ = .00, $SRMR_B$ = .08 | | | | | | | | | |

*Note.* ** $p$ < .01, Learning and Innovation skills (LI); Information skills, Media, and Technology skills (IMT); Life and Career skills (LC); Intraclass correlation (ICC).

The result of MCFA of the three factors of future skills model at the student level showed the standard factor (β) had positive values with the statistical level of .01 at both the student and major levels. The weights of standard factor were ranked in descending order as LC, LI and IMT with their respective weights of .89, .87, and .79. For the major level, weights of standard factor were ranked in descending order as LC, LI, and IMT with their respective weights of .98, .97, and .44.

The coefficient of determination ($R^2$) at the student level varied from .63 to .79, indicating that the factors could explain 63% to 79% of the variations. At the major level, coefficient of determination ($R^2$) ranged from .19 to .96, implying that the factors could explain 19% to 96%.

The result of Table 1 demonstrates the result of MCFA of future skills of undergraduate students in Cambodia were consistent with the empirical data indicated by the goodness-of-fit indices with $\chi^2$ = 4.69, *df* = 4, $\chi^2$ /*df* = 1.17, RMSEA = .02, CFI = 1.00, TLI = .99, $SRMR_W$ = .00, $SRMR_B$ = .08. The variation at major level of .05 - .16 indicated that the data had the variation, thus multilevel analysis should be performed.

Building upon these findings, Table 2 presents a more detailed breakdown of the MCFA results, focusing on the specific components of future skills.

***At the Student Level***

Learning and innovation skills (LI) consisted of three components, all of which had positive factor weights with statistical significance at the level of .01. The ranking of standard factor weights in descending order was as follows: CP, CC, and CI, with their respective weights of .84, .83, and .73. Information, media, and technology skills (IMT) consisted of three components, all of which had a positive standard factor weight with a statistical significance level of .01. The ranking of standard factor weights was as follows: IL, ML, ICT with their respective weights of .77, .74, and .71. Life and career skills (LC) consisted of five components, all of which had positive standard factor weights with a statistical significance level of. 01. The ranking of the standard factor weights was as follows: IS, FA, PA, LR, and SC, with their respective weights of .88, .86, .85, .82, and .73.

***At the Major Level***

Learning and innovation skills (LI) consisted of three components which all had positive standard factor weights with the statistical significance level of .01, ranking of the standard factor weights in descending order was as follows: CI, CP, and CC with their respective weights of 1.00, .84, and .72. Information, media, and technology skills (IMT) consisted of three components which all had positive factor weights with the

statistical significance level of .01. The ranking of the standard factor weights was as follows: ML, ICT, and IL with their respective weights of .99, .90, and .78. Life and career skills (LC) consisted of five components which all had positive factor weights with the statistical significance level of .01. The ranking of the standard factor weights in descending order was as follows: LR, PA, SC, IS, and FA, with their respective weights of 1.00, .99, .96, .94, and .80.

**Table 2**

*Results of MCFA of Future Skills (Components)*

| Future skills | The result | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Student level (Within) ($n$ = 400 students) | | | | Major level (Between) ($n$ = 50 majors) | | | | ICC |
| | β | *SE* | *t* | $R^2$ | β | *SE* | *t* | $R^2$ | |
| LI | | | | | | | | | |
| CI | .73 | .04 | 18.04** | .53 | 1.00 | .00 | 890.21** | .99 | .10 |
| CP | .84 | .03 | 29.69** | .71 | .84 | .10 | 7.95** | .70 | .15 |
| CC | .83 | .02 | 34.04** | .68 | .72 | .08 | 8.24** | .52 | .12 |
| IMT | | | | | | | | | |
| IL | .77 | .03 | 24.92** | .60 | .78 | .20 | 3.95** | .61 | .08 |
| ML | .74 | .04 | 19.46** | .56 | .99 | .00 | 487.01** | .99 | .05 |
| ICT | .71 | .04 | 15.64** | .50 | .90 | .03 | 26.67** | .80 | .16 |
| LC | | | | | | | | | |
| FA | .86** | .02 | 36.17 | .74 | .80** | .23 | 3.55 | .65 | .06 |
| IS | .88** | .02 | 39.12 | .77 | .94** | .07 | 13.64 | .89 | .11 |
| SC | .73** | .04 | 20.36 | .53 | .96** | .36 | 2.66 | .92 | .06 |
| PA | .85** | .03 | 32.84 | .72 | .99** | .05 | 19.51 | .97 | .13 |
| LR | .82** | .03 | 28.28 | .67 | 1.00** | .09 | 11.64 | 1.00 | .11 |
| $\chi^2$ = 83.96, $df$ = 78, $\chi^2$ /$df$ = 1.08, RMSEA = .01, CFI = 1.00, TLI = .98, $SRMR_W$ = .02, $SRMR_B$ = .08. | | | | | | | | | |

*Note.* **$p$ < .01, Learning and Innovation skills (LI), Creativity and Innovation skills (CI), Critical thinking and Problem-solving skills (CP), Communication and Collaboration skills (CC), Information, Media and Technology skills (IMT), Information Literacy skills (IL), Media Literacy skills (ML), Information, Communication and Technology skills (ICT), Life and Career skills (LC), Flexibility and Adaptability skills (FA), Initiative and Self-direction skills (IS), Social and Cross-cultural skills (SC), Productivity and Accountability skills (PA), Leadership and Responsibility skills (LR), Intraclass correlation (ICC).

## Qualitative Research Results

The results of in-depth interview with seven key informants revealed that the majority of the informants (7 individuals) were male, aged 31 to 40 (4 individuals), had 11 to 15 years of work experience (4 individuals), and held master's degrees (5 individuals). It was found the results were consistent with the quantitative analysis of the factors and the components. At both the student and major levels, it was discovered that the factors were ranked in descending order as LC, LI, and IMT.

When the factors were considered, at the student level, it was found that, for life and career skills, initiative and self-direction skills was the most important. For learning and innovation skills, critical thinking and problem-solving skills was the most important. Further, information, media and technology skills, information literacy skills, information literacy skills were the most important.

At the major level, leadership and responsibility skill was the most important for life and career skills. Creativity and innovation skill were the most important for learning and innovation skills. For information, media and technology skills, media literacy skill was the most important.

Each major should consider improving students' skills of initiative and self-direction skills of students because beside depending on what have been studied at university, students need to be self-learning and initiate new work by themselves.

> Even though students can learn new skills at university, however, they still need to learn by themselves. And for the new upcoming technology, teachers can sometime only just guide, but they still need to learn it by themselves. (Key informant 4)
> Critical thinking and problem-solving skills are very important. Students need to be carefully thinking before doing. (Key informant 1)
> In new the technology world, people need to catch up with the technology. Avoid living like a frog in the well. (Key informant 7)

While at major level, learner should focus on leadership and responsibility skills.

> Teachers should make sure to train students to be responsible in their work, because in the future working environment it will be useful. (Key informant 1)
> Student will not be tricked if they have enough adequate media literacy skills, because now students not only learn at school, but they also learn from the internet world. How will students cope if they cannot differentiate fake news? (Key informant 4)

**Converged Quantitative Results with Qualitative Results**

After studying both the quantitative and qualitative results, it was concluded that the future skills of undergraduate students consist of three factors: LI, IMT, and LC. Both quantitative and qualitative demonstrated that at both the student and major levels LC was the most important skills followed by LI and IMT respectively. Additionally, it was found that the assessment criteria with all 86 indicators and 102 assessments were suitable.

Table 3 explains the importance of each skill in both quantitative and qualitative data. Life and career skills are the most important skill at both the student and major levels, with a quantitative result of .89 (student level) and .98 (major level). For qualitative result, four key informants choose LC as the most important at both the student and major levels.

**Table 3**

*Factor Loading of Future Skills at Student and Major Levels Comparing Quantitative and Qualitative Findings.*

| Future skills | Quantitative finding (Factor loading) | | Qualitative finding (Frequency) | |
|---|---|---|---|---|
| | Student level | Major level | Student level | Major level |
| Learning and innovation skills (LI) | .87 | .97 | 2 | 2 |
| Creativity and innovation skills (CI) | .73 | 1.00 | 1 | 4 |
| Critical thinking and problem-solving skills (CP) | .84 | .84 | 4 | 2 |
| Communication and collaboration skills (CC) | .83 | .72 | 2 | 1 |
| Information, media, and technology skills (IMT) | .79 | .44 | 1 | 1 |
| Information literacy skills (IL) | .77 | .78 | 4 | 1 |
| Media literacy skills (ML) | .74 | .99 | 2 | 4 |
| Information, communication and technology skills (ICT) | .71 | .90 | 1 | 2 |
| Life and career skills (LC) | .89 | .98 | 4 | 4 |
| Flexibility and adaptability skills (FA) | .86 | .80 | 0 | 0 |
| Initiative and self-direction skills (IS) | .88 | .94 | 3 | 1 |
| Social and cross-cultural skills (SC) | .73 | .96 | 1 | 1 |
| Productivity and accountability skills (PA) | .85 | .99 | 2 | 2 |
| Leadership and responsibility skills (LR) | .82 | 1.00 | 1 | 3 |

Moreover, future skills criteria can be calculated though the Formula1 as the following equation:

*Student level*

Weighted Sum Model = [(.87*.73)+(.87*.84)+(.87*.83)] + [(.79*.77)+(.79*74)+(.79*71)] + [(.89*.86)+(.89*88)+(.89*73)+(.89*85)+(.89*82)] = 7.54

Score level = (7.54-0)/5 = 1.51 (score range at student level)

*Major level*

Weighted Sum Model = [(.97*1.00)+(.97*.84)+(.97*72)] + [(.44*.78)+(.44*99)+(.44*90)] + [(.98*.80)+(.98*94)+(.98*96)+(.98*99)+(.98*1.00)] = 8.24

Score level = (8.24-0/5) = 1.65 (score range at major level)

The score ranges at both the student and major levels for interpreting the level of future skills are detailed in Table 4. For example, if the future skills at the student level are evaluated to be in the range of 6.04 – 7.54, and if the future skills at the major level are evaluated to be in the range of 6.60 – 8.24, it means that the future skills are at an outstanding level.

**Table 4**

*Interpretation of Future Skills*

| Level | Student level | Major level | Interpretation |
|---|---|---|---|
| 1 | 0.00 – 1.50 | 0.00 – 1.64 | The future skills are in the level of need to improve. |
| 2 | 1.51 – 3.01 | 1.65 – 3.29 | The future skills in fair level |
| 3 | 3.02 – 4.52 | 3.30 – 4.94 | The future skills in good level |
| 4 | 4.53 – 6.03 | 4.95 – 6.59 | The future skills in very good level |
| 5 | 6.04 – 7.54 | 6.60 – 8.24 | The future skills in the outstanding level |

## Discussion and Conclusion

### Discussion of Main Results

This study aimed to develop and validate a model of future skills and corresponding assessment criteria for undergraduate students in Cambodia. The findings revealed important insights into the structure and relative importance of various skills deemed crucial for success in the 21st century Cambodian context.

At both student and major levels, life and career skills emerged as the most significant factor, followed by learning and innovation skills, and information, media and technology skills. This aligns with recent literature emphasizing the increasing importance of adaptability, self-direction, and socio-emotional competencies in rapidly changing work environments (Boun et al., 2020; Makmee, 2023). The prominence of life and career skills likely reflects the economic and social transitions occurring in Cambodia, where traditional educational approaches are being challenged by the demands of an increasingly globalized and technology-driven job market (Heng, 2024). Learning and innovation skills are acknowledged as essential for success in the 21st century, underscoring their critical role in preparing students for future career challenges (Deemee & Lincharoen, 2017; Makmee, 2021; Makmee, 2023).

Within the life and career skills domain, initiative and self-direction skills showed the highest factor loading at the student level. This finding supports the growing emphasis on self-directed learning in higher education, particularly in developing contexts where resources may be limited. Moreover, self-directed skills have a significant impact on study achievement (Makmee et at., 2024; Yoo, 2024), working abilities and goal achievement (Phanudulkitti et al., 2018). At the major level, leadership and responsibility skills emerged as the most crucial component. This aligns with Perry et al.'s (2018) assertion that fostering accountability in students not only enhances learning but also prepares them for lifelong professional

development. The emphasis on these skills may reflect the need for Cambodian graduates to take on leadership roles in various sectors as the country continues its economic development. Furthermore, the development of life and career skills is crucial not only for academic success but also for the well-being of professionals in various fields. As demonstrated in the study by Chiv et al. (2024), which examined the well-being and smoking behaviors of health officers in Thailand, there is a clear link between professional skills and personal health behaviors. This underscores the importance of developing life skills alongside professional competencies, aligning with our findings on the significance of life and career skills in the future skills framework for Cambodian undergraduate students.

In the domain of learning and innovation skills, critical thinking and problem-solving skills were found to be particularly important. This supports the findings of Nold (2017), who emphasized the role of critical thinking in enabling students to synthesize complex information and develop innovative solutions. These skills enable students to engage in logical reasoning, conduct thorough analysis to generate several solutions to challenges, and utilize supplementary resources to collect information (Hitchcock, 2018). The high ranking of these skills is especially relevant in the Cambodian context, where there is a recognized need to move beyond rote learning towards more analytical and creative approaches (Sarik, 2024). Moreover, critical thinking and effective problem-solving abilities are indispensable in daily life, as individuals frequently encounter various challenges. Approaching these challenges with critical thinking and solving them effectively are crucial, especially in professional settings (Abosede & Adesanya, 2017).

Regarding information, media, and technology skills, our findings highlight the growing importance of media literacy in the Cambodian higher education landscape. It is highly perilous to engage with media without a sufficient understanding of its functioning (Lim, 2023) and media literacy is very importance for student in the era of globalization, where biased news stories are prevalent (Prakoso et al., 2017).

Future skills assessment criteria for undergraduate student consisted of three mains latent variables such as 1) LI which consisted of CI (9 indicators, and 10 assessment criteria), CP (9 indicators, and 9 assessment criteria), CC (10 indicators and 11 assessment criteria); 2) IMT consisted of IL (5 indicators and 7 assessment criteria), ML (5 indicators and 6 assessment criteria), ICT (4 indicators, 4 assessment criteria); and 3) LC consisted of FA (10 indicators and 12 assessment criteria), IS (10 indicators and 13 assessment criteria), SC (5 indicator and 6 assessment criteria), PA (10 indicators and 11 assessment criteria), and LR (10 indicators and 12 assessment criteria). This framework is consistent with the frameworks proposed by Germaine et al. (2016); Partnership for 21st Century Skills (2009); and Trilling and Fadel (2009) which describe 21$^{st}$ century skills or future skills as the combination of soft skills and technology. These skills encompass the knowledge, skills, and dispositions necessary for success in the global workplace of the future (Makmee, 2023).

In conclusion, future skills are essential for everyone in this generation to lead fulfilling lives. In today's rapidly changing world, learning and working environments require individuals to possess these skills to stay updated on information related to education, current events, work, health, and travel. These skills enable individuals to navigate through life more effectively compared to those who lack them. It is evident that skills and behaviors are closely intertwined and mutually influential in various aspects of an individual’s life. Acquiring and mastering a skill often necessitates the development of specific behaviors, such as discipline, determination, and resilience. Conversely, one's behavior can also influence the level of skill attainment, as positive attitudes, motivation, and communication skills can significantly impact one’s ability to learn and enhance a skill.

**Limitations**

In this study, a multilevel model for future skills and corresponding assessment criteria were established. However, the researchers have not developed an evaluation form and user guide for these

assessment criteria. Therefore, it is crucial for them to create the assessment form and comprehensively evaluate additional factors for its application. Despite these limitations, these findings lay the groundwork for the researchers' future research plan, which aims to delve deeper into the subject matter. Moreover, it is crucial to study guideline to cultivating future skills according to the most significant skills, so that teacher can use it as guideline to enhance students' s skills.

## Implications for Behavioral Science

Within the field of behavioral science, this study provides valuable insights into Cambodian students' future skills and evaluation standards. These findings could be utilized to assess not only students' skills but also their behaviors. It is evident that students still face challenges in areas such as flexibility, critical thinking, creativity, problem-solving, and teamwork (Boun et al., 2020; Nold, 2017). The implications of this study are significant for lecturers, educators, and students aspiring to work in various fields. It highlights the importance of developing curricula that align with the expectations of the future workforce. By enhancing the aforementioned skills, students can acquire new abilities that will be essential for their success upon graduation and entry into the workforce. This study enhances the field of behavioral science by providing insight and guidance to students and criteria for assessing their skills, enabling them to acquire the necessary skills demanded by the business and secure employment upon graduation.

### *Practical Implications*

Curriculum development: Universities in Cambodia should consider redesigning curricula to place greater emphasis on life and career skills, particularly initiative, self-direction, leadership, and responsibility. This could involve incorporating more project-based learning and real-world problem-solving activities. There is a need to shift towards teaching methods that foster critical thinking and problem-solving skills. This might include more case-based learning, debates, and interdisciplinary projects. In technology integration, given the importance of information, media, and technology skills, universities should invest in digital infrastructure and integrate technology-based learning across all disciplines. Moreover, the assessment criteria developed in this study can be used to create more comprehensive evaluation tools that go beyond traditional academic measures to include future skills.

### *Research Implications*

In longitudinal studies, future research should examine how the acquisition of these skills impacts students' academic performance and post-graduation outcomes in the Cambodian context. For, cross-cultural comparisons, comparative studies with other Southeast Asian countries could provide insights into regional trends and best practices in future skills development. On skill development interventions, research is needed to design and evaluate specific interventions aimed at enhancing the most critical skills identified in this study. Industry alignment, studies exploring the alignment between the skills prioritized in this model and the needs of Cambodian employers could further validate and refine the model.

## Conclusion

In conclusion, this study provides a comprehensive framework for understanding and assessing future skills among Cambodian undergraduate students. By highlighting the most critical skills and providing assessment criteria, it offers valuable guidance for educators, policymakers, and researchers working to prepare Cambodian youth for the challenges and opportunities of the 21st century workplace.

**Declarations**

***Conflicts of Interest:*** There is no conflict of interest in this research.

***Ethical Approval Statement:*** The study was conducted in accordance with the Declaration of Helsinki, and approved by the Burapha University's Research Ethics Committee. The project number is 024/2563 was issued on May 3, 2019.

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