Measuring Self-Directed Learning: A Diagnostic Tool for Adult Learners

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Abstract

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Abstract

Self-directed learning is an important form of adult learning (Caffarella, 1993; Knowles, 1975; Knowles, Holton & Swanson, 2005; Merriam, 2001; Merriam & Caffarella, 1999). The strategies of self-directed learning allow adult learners to cope better with their studies while fulfilling family, work and other commitments. This study conceptualised and validated a learning diagnostic test in the context of SIM University (UniSIM), an adult learning institution, in Singapore. The learning diagnostic tool allows the students to identify their strengths and weaknesses in areas of self-directed learning. The study employed a survey research methodology. 1,960 students responded to the survey, and the statistical methods of exploratory and confirmatory factor analysis were used in the analysis. The confirmatory factor analysis showed that the final model of self-directed learning, as actualised through the items of the learning diagnostic tool, has a good fit on the data, thus affirming the strong validity and reliability of the tool. This validated learning diagnostic tool currently serves as one of the student learning support measures to help UniSIM students to be self-directed learners.

Keywords

factor analysis, learning diagnostics, self-directed learning

Introduction

An adult student is typically a student above 24 years old who is juggling different roles as a student, worker, spouse and/or parent and is at least one year absent from studying in a learning institution (Howell 2001; Vander Zanden 2007). In Singapore, adult learners generally undertake government government-subsidised part-time degrees in one of the three publicly funded universities (National University of Singapore, Nanyang Technological University and Singapore Management University) or Singapore's only private university, SIM University (UniSIM). Others undertake degrees courses offered by foreign universities through private educational institutions. It was in the context of SIM University, which has an enrolment of 14,000 adult learners, that this research was situated.

Self-directed learning is an important form of adult learning (Caffarella 1993; Knowles 1975; Knowles, Holton & Swanson 2005; Merriam 2001; Merriam & Caffarella 1999). Brockett and Hiemstra (1991) proposed that self-directed learning involves a process that centres on the learners assessing their learning needs, securing the relevant learning resources and activities, conducting the planned learning activities and, finally, assessing their resultant learning. For students to be self-directed learners, Doyle (2008, p.69) identified a number of important personal skills they need to master:

- Finding and evaluating quality sources of information
- Identifying important information in quality sources
- Organising information in meaningful ways
- Writing reports and papers
- Managing time
- Remembering what has been learned
- Using problem-solving systems
- Monitoring one's own learning (meta-cognition)

In addition, Candy (1991) and Knox (1986) stated that the types of learning strategies andresources used by self-directed students may be group-based too. The learning resources and activities may include study-group collaboration, internships, online discussion and group learning activities. According to Jossberger, Brand-Gruwel, Boshuizen and Wiel (2010), a self-directed learner can self-regulate their learning. Ambrose, Bridges, DiPietro, Lovett and Norman (2010, pp.192-193) offered a meta-cognitive model for a self-regulation cycle:

- Assess the task at hand, taking into consideration the task's goals and constraints.
- Evaluate their own knowledge and skills, identifying strengths and weaknesses.
- Plan their approach in a way that accounts for the current situation.
- Apply various strategies to enact their plan, monitoring their progress along the way.
- Reflect on the degree to which their current approach is working so that they can adjust and restart the cycle as needed.

This model is somewhat similar to the cycle of self-regulation proposed by Zimmerman (2000) and Pintrich (2004), which consists of a forethought and planning phase, performance-monitoring phases and a performance-reflection phase.

The concept of self-directed and self-regulated learning are not distinguished clearly in the literature, and in fact are used interchangeably in many studies (Saks & Leijen 2014). Although there are some theoretical differences between self-directed and self-regulated learning, their fundamental operationalising principles remain the same (Garrison 1997; Jossberger, Brand-Gruwel, Boshuizen & Wiel 2010; Robertson 2011; Saks & Leijen 2014). Since this study focused on strategies to be better learners, instead of theories of self-directed learning, there was no attempt to distinguish between the concepts of self-directed and self-regulated learning.

The sustainability of self-regulated learning depends significantly on the motivation of the learner (Pintrich 2000; Wang & Holcombe 2010; Zimmerman 2008). Learners' motivation guides their determination of the value of the learning tasks and the level of persistence and effort they devote to achieving them (Ommundsen, Haugen & Lund 2005; Wang & Holcombe 2010). Self-regulation processes include goal-setting (Schunk 2001; Grow 1991; Zimmerman 2008), planning the strategies and timelines to achieve the goals (Ambrose et. al. 2010; Pressley & Woloshyn 1995; Schunk 2001; Zimmerman 2008) and flexibly implementing learning strategies (Ambrose et. al. 2010; Paris & Paris 2001; Zimmerman 2008). The strategies used to achieve the learning goals may include (among others) reading, writing, listening, asking, note-taking, memorisation techniques and collaborating with peers (Ambrose et. al. 2010; Doyle 2008; Grow 1991; Hofer, Yu & Pintrich 1998; Newman 2008; Weimer 2002). These strategies are generally similar to those proposed by authors who studied self-directed learning, since their fundamental operationalising principles are generally similar.

Learners' level of self-regulation is found to be positively correlated to their academic performance, motivation and persistence (Baker, Chard, Ketterlin-Geller, Apichatabutra & Doabler 2009; Schunk 1996; Cleary, Platten & Nelson 2008; Zimmerman & Kitsantas 1999). Courses on study skills that are designed to increase students' self-regulation are effective in preparing them for school learning (Byrd & McDonald 2005; Cofer & Somers 2000; Derby & Smith 2004; Perels, Dignath & Schmitz 2009; Wigfield, Guthrie, Perencevich, Taboada, Klauda, McRae & Barbosa 2008). Therefore, it is important that students learn the relevant self-regulation or self-directed learning skills and strategies to be successful. To increase and enhance the strategies they can used to improve their self-direction or self-regulation in learning, other than personal discovery, which is usually long and frustrating (Zimmerman 2000), useful strategies can be imparted to them through direct instruction (Zimmerman 2008), guided and independent practice (Lee, McInerney & Liem 2010), instructor feedback (Duijnhouwer, Prins & Stokking 2010; Labuhn, Zimmerman & Hasselhorn 2010), peer support (Patrick, Ryan & Kaplan 2007) and pedagogical adaptation (Gibson, Hauf & Long 2011; Graham & Harris 2005).

In the context of UniSIM, a number of resources and workshops help adult students build up their repertoire of self-directed learning strategies. However, the students might not know the strategies of self-directed learning in which they are strong or weak. Only when the students know which of the self-directed learning skills they are lacking can they use the available resources effectively. Therefore, this study aimed to help UniSIM student identify their strengths and weaknesses in self-directed learning by designing and validating a learning diagnostic tool in the context of UniSIM.

Methodology

Data collection

To understand UniSIM students' learning patterns and needs, an invitation to participate in an anonymous and voluntary online survey was sent to 12,698 students from 22 July 2013 to 9 September 2013. A total of 1,695 students responded to the survey (a 13.4% response rate), and 1,219 students completed it. The survey contained items that were designed to hypothetically measure students' level of competence in self-directed learning skills. The respondents were randomly selected into two groups in the process of validating the learning diagnostic tool. One group consisted of 741 respondents (to ensure an acceptable ratio of subjects to variables) whose data was used in the exploratory factor analysis process to reduce the items in the original list of items that had been hypothesised to measure different competence levels of students' self-directed skills. The other group consisted of 478 respondents whose data were used in the confirmatory factor analysis process to confirm the conceptual structure of students' self-directed learning skills competence in the context of UniSIM, thus further validating the questionnaire.

Design of tool items

From the literature review conducted in this study, 70 conceptualised items were formulated in the questionniare to measure different aspects of self-directed learning skills. They were then checked for content validity by faculty members in the Teaching and Learning Centre at UniSIM.

Validation of tool items

The validation process for the tool items was conducted through factor analysis. The ratio of subjects to variables in this factor analysis process was 10:6. The extraction method Principal Axis Factoring and Oblimin's rotation method were used in the analysis. The original list of items, each item evaluated on a scale of 1 (Strongly Disagree) to 7 (Strongly Agree) used in the factor analysis is shown in Table 1.

Table 1: Original list of items used in the factor analysis

No.	Item
1	I can see the benefits for my work and/or personal development from completing the program.
2	I do not monitor how much I have achieved in terms of learning at each stage of a course.
3	I know what I want to achieve in terms of learning from the program.
4	I am at a loss as to what I should be learning over the duration of a course.
5	I set targets to achieve for assignments and examinations for each course.
6	I do not know why I chose the degree program I have enrolled in.
7	I find time to study the learning materials and/or resources in a course.
8	I do not know what I'm supposed to be doing whenever I sit down to study.
9	I feel that I have too much to accomplish in terms of learning towards the end of each course.
10	I do not submit my assignments on time.
11	I plan what I need to learn in a course.

12	I set aside enough time to study for examinations and/or do the assignments in a course.
13	I persist in finishing uncompleted study tasks as quickly as possible.
14	I keep postponing my study tasks designated in a course.
15	I find studying for the course is of high priority for me.
16	I prefer to do other things than study the learning materials or resources.
17	I find excuses for not studying for courses.
18	I follow my study schedule.
19	I do not understand what my instructor says during online presentations.
20	I do not know how to pick up important information during online presentations.
21	I cannot focus during online presentations.
22	I do the required reading before online presentations.
23	I can follow the pace of online presentations.
24	I reflect on what I have learnt during online presentations.
25	I do not understand the assigned readings.
26	I cannot relate the content of the readings to the course objectives.
27	I relate the content of the learning materials or resources to my work or life.
28	I understand what I have written in my own notes taken in seminars or online presentations.
29	I do not know how to make notes from my readings.
30	My notes are sufficient to help me prepare for examinations/assignments.
31	I do well on my assignments.
32	I do not know what is required in my assignments.
33	I do not know how to write my assignments.
34	I am able to present the information in my assignments clearly.
35	The information I gathered for my assignments is relevant.
36	I do not know what information to search for in doing my assignments.
37	I learn from my instructor and peers during online discussions.
38	I do not know how to prepare for online discussions.
39	I can follow the content of threaded discussions.
40	I do not know what to write in response to discussion topics posted on discussion forums.
41	I love attending seminars.
42	I am physically drained when I am studying.
43	I feel motivated whenever I am studying.
44	I fear not doing well on my assignments/assessments.
45	I am demoralised when I do not meet the expectations I set for myself in my studies.
46	I do not worry about not submitting my assignment on time.
47	I do not understand what my instructor says during the seminar sessions.
48	I do not know how to pick up important information during seminars.
49	I cannot focus during seminars.

50	I do the required reading before seminars.
51	I learn from my instructor and peers during seminars.
52	I reflect on what I have learnt during seminars.
53	I can remember the required facts and knowledge during tests and examinations.
54	I am nervous during tests and examinations.
55	I am able to complete all the questions in tests and examinations.
56	I do not understand what is required of me when tackling the questions in tests and examinations.
57	I do poorly in tests and examinations.
58	I feel confident when taking tests and examinations.
59	The internet makes my life more interesting.
60	I try to avoid study work that needs computers.
61	I use social media such as Facebook, Twitter, internet forums etc. regularly.
62	I feel intimidated whenever I use the internet.
63	I have problems using computer software and hardware.
64	I am very comfortable using a computer.
65	The internet provides me with a wealth of resources for my assignments.
66	I do not know how to evaluate and extract relevant information from the internet for my assignments.
67	I am able to use the information I gathered in my assignments meaningfully.
68	I do not know how to use the library resources.
69	I spend too much time researching information for my assignments.
70	The library resources are very useful for researching my assignments.

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.858, and the Bartlett's Test of Sphericity was significant (χ^2 (325) = 7861.886, $p < .05$). The determination of the correlation matrix was approximately 0.0000212. There were two (0.0%) non-redundant residuals between observed and reproduced correlations with absolute values greater than 0.05. A 10-factor solution (Table 2) was produced; it accounted for 60.04% of the variation in the data. Forty-four items were removed from the original list of items.

Table 2: Pattern matrix of the 10-factor solution

Pattern Matrix[a]

	Factor									
	1	2	3	4	5	6	7	8	9	10
Cronbach's Alpha Coefficient	.783	.860	.721	.782	.791	.816	.662	.859	.697	.749
The information I gathered for my assignments is relevant. (F1.1)	.851									
I am able to present the information in my assignment clearly. (F1.2)	.716									
I do not know how to pick up important information during online presentations. (F2.1)		.851								
I do not understand what my instructor says during online presentations. (F2.2)		.803								
I cannot focus during online presentations (F2.3)		.768								
I fear not doing well for my assignments/assessments. (F3.1)			.769							
I am demoralised when I do not meet the expectations I set for myself in my studies. (F3.2)			.709							
I feel intimidated whenever I use the internet. (F4.1)				.854						
I have problems using computer software and hardware. (F4.2)				.802						
I try to avoid study work that needs computers. (F4.3)				.554						
I find excuses for not studying for courses. (F5.1)					-.955					-.102
I prefer to do other things than study the learning materials or resources. (F5.2)					-.596		.114	-.131		
I keep postponing my study tasks designated in a course. (F5.3)					-.478					.181
I do not know how to prepare for online discussion. (F6.1)						-.810				
I do not know what to write in response to the discussion topics posted on discussion forums. (F6.2)						-.785				
I learn from my instructor and peers during seminars. (F7.1)							.772			
I reflect on what I have learnt during seminars. (F7.2)							.470			.277
I love attending seminars. (F7.3)					-.122		.462			
I cannot relate the content of the readings to the course objectives. (F8.1)								-.920		
I do not understand the assigned readings. (F8.2)								-.766		
I do poorly in tests and examinations. (F9.1)									.867	
I feel confident when taking tests and examinations. (F9.2)	.178		.131						.399	.144
I plan what I need to learn in a course. (F10.1)										.693
I set targets to achieve for assignments and examinations for each course. (F10.2)	.110		-.270						.109	.507
I set aside enough time to study for examinations and/or do the assignments in a course. (F10.3)										.494
I find time to study the learning materials and/or resources in a course. (F10.4)										.484

Extraction method: Principal Axis Factoring
Rotation method: Oblimin with Kaiser Normalisation.[a]
a.   Rotation converged in 10 iterations.
b.   Coefficients less than 0.100 were not reflected in the table.

Each pattern coefficient of the solution was at least 0.462, and a mean pattern coefficient of 0.698 was obtained for all factors, with a minimum of 0.545 for factor individually. The reliability of each factor was expressed by a Cronbach's alpha coefficient of at least 0.662. The correlation between the factors was not more than 0.531.In summary, the list of hypothesised tool items used

to measure self-directed learning skills in this study was reduced to a 10-factor model with 26 items. The model's adequacy, content validity, discriminant validity, convergent validity and reliability were evaluated and assured in general.

Fit evaluation of the model

This stage evaluated the fit of the 10-factor model in understanding the learning needs of students in terms of their self-directed learning skills. The 10-factor model exihibited a good fit with χ^2 (254) = 474.907, CFI = 0.952, RMSEA = 0.043 and RMR = 0.078. All the error variances were statistically significant. Below is the diagrammatic representation of the factors.
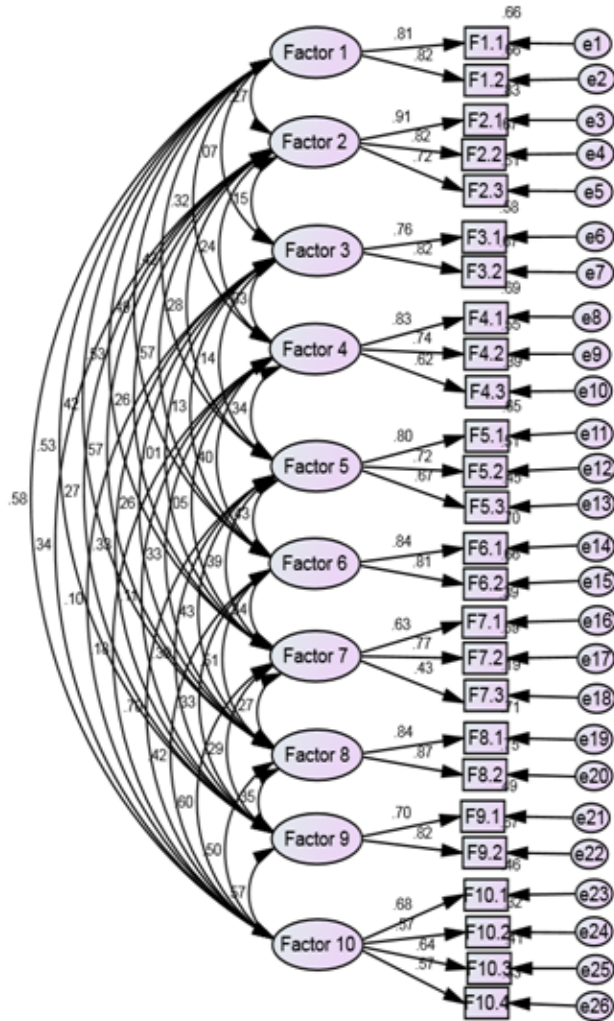

Figure 1: Diagrammatic presentation of the 10-factor solution

In summary, the fit of the model was good, and it could be expected that it would sufficiently and validly represent the types of self-directed learning skills experienced by the students in the context of UniSIM.

Naming of factors

To facilitate the implementation of the diagnostic tool, the various factors were named as shown in Table 3.

Table 3: Names of the factors

FACTOR	ITEM	NAME	DEFINITION
1	The information I gathered for my assignments is relevant. (F1.1) I am able to present the information in my assignment clearly. (F1.2)	Assignment Management	Ability to plan, do and score well in the Tutor marked Assignments and Group Based Assignments
2	I do not know how to pick up important information during online presentations. (F2.1) I do not understand what my instructor says during online presentations. (F2.2) I cannot focus during online presentations (F2.3)	Online Learning Proficiency	Ability to learn from online synchronous and asynchronous lectures and video lectures
3	I fear not doing well for my assignments/assessments. (F3.1) I am demoralised when I do not meet the expectations I set for myself in my studies. (F3.2)	Stress Management	Ability to handle academic stress
4	I feel intimidated whenever I use the internet. (F4.1) I have problems using computer software and hardware. (F4.2) I try to avoid study work that needs computers. (F4.3)	Technical Proficiency	Ability in handling UniSIM learning management system
5	I find excuses for not studying for courses. (F5.1) I prefer to do other things than study the learning materials or resources. (F5.2) I keep postponing my study tasks designated in a course. (F5.3)	Procrastination Management	Ability to manage procrastination in learning
6	I do not know how to prepare for online discussions. (F6.1) I do not know what to write in response to discussion topics posted on the discussion forums. (F6.2)	Online Discussion Proficiency	Ability to do well in online discussion forums
7	I learn from my instructor and peers during seminars. (F7.1) I reflect on what I have learnt during seminars. (F7.2) I love attending seminars. (F7.3)	Seminar Learning Proficiency	Ability to learn during seminars
8	I cannot relate the content of the readings to the course objectives. (F8.1) I do not understand the assigned readings. (F8.2)	Comprehension Competence	Ability to understand readings and make study notes
9	I do poorly in tests and examinations. (F9.1) I feel confident when taking tests and examinations. (F9.2)	Examination Management	Ability to plan, do and score well in examinations
10	I plan what I need to learn in a course. (F10.1) I set targets to achieve for assignments and examination for each course. (F10.2) I set aside enough time to study for examinations and/or do the assignments in a course. (F10.3) I find time to study the learning materials and/or resources in a course. (F10.4)	Time Management	Ability to utilise study time effectively

Tool-delivery platform

This tool was developed as an Excel-based application. The 26 items in the 10-factor model developed through the factor-analytic process were used in the diagnostic tool. After students

completed the diagnostic tool, they were given a report on how well they had done in each of the 10 domains. The content of the report included:

a) The respondent's mean score in each of the domains with reference from the corresponding mean score from the survey-validation population (Table 4).
b) The domains in which the respondent might be weak, taking the mean score of the subpopulation of respondents who scored a GPA of less than 2.0 out of a total of 5.0 (Table 5).
c) The domains in which the respondent was doing well, taking the top 30th percentile score as a reference (Table 6).

Students who had taken the diagnostic test could then focus on strengthening the self-directed skills in which they were weak, as detailed in the report (Figure 2).

Table 4: Mean score in each domain for all respondents

		Assignment management	Online learning proficiency	Stress management	Technical proficiency	Procrastination management	Online discussion proficiency	Seminar learning proficiency	Comprehension competence	Examination management	Time management
N	Valid	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		4.8794	4.0850	2.4471	5.2382	4.8048	4.4147	5.087	4.5422	4.1579	5.2240
Median		5.0000	4.0000	2.0000	5.3333	5.0000	4.5000	5.000	4.5000	4.0000	5.2500
Std. Deviation		.95454	1.3924	1.1397	1.1951	1.22611	1.3537	.9415	1.18819	1.2218	.93656
Minimum		1.50	1.00	1.00	1.00	1.00	1.00	1.67	1.00	1.00	1.75
Maximum		7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

Table 5: Mean score in each domain for all respondents who had a CGPA between 0 and 2

What is your current Cumulative Grade Point Average (CGPA)?			Assignment management	Online learning proficiency	Stress management	Technical proficiency	Procrastination management	Online discussion proficiency	Seminar learning proficiency	Comprehension competence	Examination management	Time management
0-1.99	N	Valid	42	42	42	42	42	42	42	42	42	42
		Missing	0	0	0	0	0	0	0	0	0	0
	Mean		4.4524	3.8095	2.2262	4.7460	4.4286	4.1786	4.6429	4.1786	3.2381	4.6845

Table 6: Percentile values of each factor

		Assignment management	Online learning proficiency	Stress management	Technical proficiency	Procrastination management	Online discussion proficiency	Seminar learning proficiency	Comprehension competence	Examination management	Time management
N	Valid	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
	Missing	0	0	0	0	0	0	0	0	0	0
Percentiles	10	4.0000	2.0000	1.0000	3.6667	3.0000	2.5000	3.6667	3.0000	2.5000	4.0000
	20	4.0000	3.0000	1.5000	4.0000	3.6667	3.0000	4.3333	3.5000	3.0000	4.5000
	30	4.5000	3.3333	2.0000	4.6667	4.0000	4.0000	4.6667	4.0000	3.5000	4.7500
	40	4.5000	4.0000	2.0000	5.0000	4.3333	4.0000	5.0000	4.0000	4.0000	5.0000
	50	5.0000	4.0000	2.0000	5.3333	5.0000	4.5000	5.0000	4.5000	4.0000	5.2500
	60	5.0000	4.3333	2.5000	6.0000	5.3333	5.0000	5.3333	5.0000	4.5000	5.5000
	70	5.5000	5.0000	3.0000	6.0000	5.6667	5.5000	5.6667	5.0000	5.0000	5.7500
	80	6.0000	5.3333	3.0000	6.3333	6.0000	6.0000	6.0000	6.0000	5.0000	6.0000
	90	6.0000	6.0000	4.0000	6.6667	6.3333	6.0000	6.0000	6.0000	6.0000	6.2500

A) Below is the table that shows your score in the various domains as compared to the validation sample and the category of students of different academic competence, in terms of CGPA.

Study and self-regulation skill	Your average score	The sample's average score (N=1,219)	Average score of participants in sample who did not do well in studies (CGPA less than 2)	Description of each domain
	Scores range from 1 (very low competence) to 7 (very high competence)			
Assignment management	7.0	4.9	4.5	Assignment management refers to your ability to plan, do and score well in your TMAs and GBAs.
Online learning proficiency	6.3	4.1	3.8	Online learning proficiency refers to your ability to learn from online synchronous and asynchronous lectures and video lectures.
Stress management	6.5	2.4	2.2	Stress management refers to how well you handle academic stress.
Technical proficiency	1.7	5.2	4.7	Technical proficiency refers to your ability to handle the UniSIM learning-management system.
Procrastination management	1.0	4.8	4.4	Procrastination management refers to how well you manage procrastination in learning.
Online discussion proficiency	6.5	4.4	4.2	Online discussion proficiency refers to your ability to do well in online discussion forums.
Seminar learning proficiency	6.3	5.1	4.6	Seminar learning proficiency refers to how effectively you learn during seminars.
Comprehension competence	7.0	4.5	4.2	Comprehension competence refers to your ability to understand your readings and make study notes.
Examination management	6.5	4.2	3.2	Examination management refers to your ability to plan, do and score well in your examinations.
Time management	1.5	5.2	4.7	Time management refers to your ability to use your study time effectively.

B) The two tables below shows the areas where you are performing well or you might be lacking.

You are doing well in these areas, as your average score belongs to the top 30% score in the sample.	Assignment management	Online learning proficiency	Stress management		
	Online discussion proficiency	Seminar learning proficiency	Comprehension competence	Examination management	

You might need some help in these areas, as your average score is equivalent to or less than those in the sample who did not do well in their studies.				Technical proficiency	Procrastination management
					Time management

Figure 2: Learning-diagnostic test report

Conclusion

This research detailed the design and validation of a learning-diagnostic tool that aims to help students do well in their learning journey at UniSIM. This learning-diagnostic tool serves as the first line of self-diagnosis for students to understand their own learning needs. However, it should be kept in mind that this tool cannot be the sole mechanism to help students identify their weaknesses in self-directed learning skills. At UniSIM, a comprehensive network of detection and intervention, operated by associate faculty members, instructors and counsellors, is available to help students who are not performing well in their learning.

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