Investigating the Relationships among College Students' Online Self-Regulated Learning, Grit and 5C[1] Competences

Wei Sun[2]
Chang Xu[3]
& Yan Dong[4]

Abstract

The competences of communication, collaboration, critical thinking, complex problem solving and creativity (5C) have already been widely emphasized by scholars and educators as important abilities in the 21st century society (Hwang, Lai, Liang, Chu, & Tsai, 2017). This study aims to investigate the effects of grit and self-regulated learning on learners' 5C competences in an online learning environment and measuring it through a quantitative survey. 103 Higher Education students participated in the study. The results of the study are: (1) communication can also be subdivided into two sub-dimensions: communication ways and communication feeling; (2) students' consistency of interests is not related to their self-regulated learning and 5C competences; (3) the results of linear regression indicated that students' perseverance of effort could predictor their 5C competences, and students' self-regulated learning especially goal setting, environment structuring, task strategies, help seeking and self-evaluation all positive impact their 5C competences. The findings suggested us the important meaning to develop students' characteristic and quality of grit to help students monitor, reflect and adjust their online learning, and develop their key skills ultimately. Implications of the findings for additional research and instruction are discussed.

Keywords：Online Self-Regulated Learning, Grit, Collaboration, Complex Problem Solving, Creativity, Communication, Critical Thinking

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[1]5C: communication, collaboration, critical thinking, complex problem solving and creativity
[2]Master, Faculty of Education, Beijing Normal University, China, e-mail: bnusw0512@mail.bnu.edu.cn
[3]PhD, Faculty of Education, Beijing Normal University, China, ,e-mail: merryxc_1991@163.com
[4] Professor, Faculty of Education, Beijing Normal University, China, e-mail: yan.dong@bnu.edu.cn (Correspondent author)

Introduction

The current era is a knowledge-based economy based on knowledge and brainpower, and an era of rapid development of information technology based on computers and the Internet. With the rapid development of technology being present in various sectors of society it is also very prominent in the field of education by changing its learning environment and learning ways (Bruin, & Merriënboer, 2017). Students can acquire knowledge not only from their teachers, but also from the Internet. Online learning is becoming a new way to learn and something you seek to know. In response to the development of technology, nowadays many countries are promoting education information and accelerating the use of information technology to promote the effectiveness of teaching and learning. In China, the Chinese government has attached great importance to the application of technology in the field of education. It has published several documents which emphasize the importance of the application of technology in teaching and learning. This is evidenced in various publications over time (National Medium and Long-term Education Reform and Development Plan, 2010, Ministry of Education of People's Republic of China, 2010, National Development Plan for ICT in Education (2011-2020).

Online learning can make full use of computing technology and Internet technology to ensure learners can learn anytime, anywhere. Use of fragmentation time to learn, can break the limitation of time and space in traditional education. However, if the learner does not have good self-control, they can be easily distracted by other web news during the learning process. Lack of accompanying teachers who can supervise students is also a variable and some students will drop out before they finish a course. This paper aims to determine the relationships amongst students' personality traits, self-regulation and 5C of online learning students. The results are expected to help students clearly understand their traits, self-regulation and how to affect their online learning outcomes and whether online learning experience will affect their 5c.

Literature Review

1. Concepts

1.1 Grit

The concept of Grit was first presented by A.L. Duckworth, an Asian American psychologist and associate professor at the University of Pennsylvania. Duckworth (2005) discussed the role of self-discipline in an article entitled "Self - discipline outdoes IQ in predicting academic performance of adolescents". This pioneering research was labeled as the "Grit research" and was inspired by the film True Grit (Henry Hathaway, 1969).During a speech, Duckworth defines the concept as the quality of "working towards a long-term goal and maintaining a passionate state. That is, encountering failure and setbacks, and still making unremitting efforts"(Duckworth, 2005).

In China, the focus on grit quality can be traced back to Zenzione of the Confucius' students, which states that 'an educated gentleman cannot but be resolute and broad-minded, for he has taken up a heavy responsibility and a long course. Is it not a heavy responsibility, which is to practice benevolence? Is it not a long course, which will end only with his death?' The Analects of Confucius Tabe). Grit has always been one of the evaluation criteria for people, and people have been encouraging each other to have this quality of life, such as encouraging friends not to give up or speaking out of turn.

1.2 Self-regulated learning

Self-regulated Learning (SRL) was first defined by Bandura in 1986 and he defined self-regulated Learning as a three-regulated process: self-observation, self-judgment, and self-reflection. Learners first need to systematically observe their learning behaviors through the aspects of learning progress and learning quality, so as to obtain their learning progress information in the learning process; Secondly, learners need to compare the current learning state with the set learning goal, which is self-judgment. The gap between the current learning situation and the set goal can be found through self-judgment. Some scholars pointed out that self-judgment can not only provide learning feedback information but also play a role in influencing learning motivation (Guotao, 1995）. Thirdly, after self-judgment and finding the gap between the current state and the expectation, learners also need to self-react, evaluate whether they are satisfied with the current learning results, adjust their learning behavior and adjust the learning environment, so as to prepare for more effective learning in the future.

Zimmermann (1989) pointed out that self-regulation learning refers to learners using cognitive regulation strategy and strategy of motivation to promote their own learning, by choosing their own learning method which favors the construction and the process of creating a favorable learning environment. He also summarized three characteristics of self-regulated learning :(1) self-regulated learners can actively participate in their own learning process in metacognition, motivation and behavior; (2) self-regulation learning is a process of constant circulation and repeated adjustment; (3) learners can control themselves (Zimmerman, & Schunk, 2004).

1.35C

Key literacy, also known as 21st century learning skills, is the main focus of the process of shaping the blueprint of future education at home and abroad, which has triggered a series of teaching innovation practices. Each country has their own definition of key literacy; in China some scholars use the5C which consists of five abilities, communication, collaboration, critical thinking, complex problem solving and creativity (Hwang, Lai, Liang, Chu, & Tsai, 2017).

2. Literature review

The Grit questionnaire contains two aspects: consistency of interests and perseverance of effort. Woltersand Hussain (2015) found that the second part is very strongly associated with self-regulation, whilst self-regulation serves as a mediator of grit. Cho, Kim and Choi (2017) conducted a study about whether learners' self-regulation will affect their outcomes during online learning. They found that there are positive correlations between self-regulated levels and self-efficacy and students with high self-regulation will have a high self-efficacy than students with low self-regulation. Eastin et al (2000) carried out a survey about students' internet self-efficacy and proved that students' internet self-efficacy had a significant relationship to their experience. They further argued that internet stress is negatively related to efficacy beliefs, while prior internet experience will affect the outcome of their online learning. Chuang, Lin and Tsai(2015)explored the relationship between Internet self-efficacy and sources of Internet self-efficacy among Taiwanese university students. The result of the study suggested that if students use the Internet to solve problems, communicate with others, verify information, apply software, and learn new things in the

Internet-based environment, students' psychological and affective states might play an important role.

ChihHsuan et al (2013) carried out a survey about students' characteristics, self-regulated learning, technology self-efficacy, and course outcomes in online learning. The survey showed that students' self-regulated learning and their technology self-efficacy have an important effect on their online learning outcomes. Prior et al (2016) studied students' attitude, digital literacy and self-efficacy and whether they affect their online learning behavior. They found that students' positive learning attitude will enhance their self-efficacy, then will affect their outcomes of online learning. Finally, Lim and Kim (2003) looked into students' online learning motivation and their characteristics and whether they affect their learning outcomes. They came to the conclusion that students' characteristics and their motivation types will affect undergraduate students' online learning outcomes.

Methodology

1. Sample

The participants of this study included 102 university students with online learning experience (including 29 males and 73 females) in Beijing Normal University. They were either undergraduate or graduate students, of which were 23 freshmen, 74 masters and 5 PhD students. They were 80 Chinese students and 22 international students.

2. Data collection tools

In this study a five-point Likert-type scale questionnaire was used: a score of 1 indicated "not at all true of me" and 5, "very true of me". The questionnaire includes three different scales. They are grit, 5C, online self-regulated learning. (Please see Appendix A)

The grit scale was developed by Duckworth et al (2007). It consists of two dimensions, one is consistency of Interests, and the other is perseverance of effort, with a total of 12 items.

The 5C questionnaire has 22 items developed by Hwang et al (2017), which include communication, collaboration, critical thinking, complex problem solving and creativity. Over a yearly period they aimed to investigate the relationships between students' perceptions and their tendencies of their five kind of abilities of online.

The online self-regulated questionnaire has 24 items in total, which was developed by Barnard et al (2008), this questionnaire included goal setting, environmental construction, task strategy, time management, help seeking and self-evaluation.

3. Results analysis

a. Descriptive analysis

The descriptive analysis includes gender, countries and grades analysis. Participants were 29 males and 73 females. The 102 valid questionnaires included 80 Chinese students and 22 international students.

b. Reliability analysis

The grit scale's reliability is 0.709, the 5C scale's reliability is 0.874, the self-regulated scale's

reliability is 0.863.

Table1Reliabilityanalysisresults

Scales	Cronbach's Alpha	Items
Grit	.709	12
SRL	.863	24
5C	.874	22

c. Factor analysis

(1) Grit

The data analysis results show that the KMO statistic is 0.734, indicating that the structural validity of the questionnaire is good, and the Bartlett sphere test value is 166.876. The significance level of the chi-square statistical value is 0.000, less than 0.01, and there is a high correlation between the indicators. The data is suitable for factor analysis.

(2) SRL

The data analysis results show that the KMO statistic is 0.773, indicating that the structural validity of the questionnaire is good, and the Bartlett sphere test value is 798.318. The significance level of the chi-square statistical value is 0.000, less than 0.01, and there is a high correlation between the indicators. The data is suitable for factor analysis.

(3) 5C

The data analysis results show that the KMO statistic is 0.742, indicating that the structural validity of the questionnaire is good, and the Bartlett sphere test value is 653.464. The significance level of the chi-square statistical value is 0.000, less than 0.01, and there is a high correlation between the indicators. The data is suitable for factor analysis.

d. Correlation analysis

As we wanted to explore the relationship amongst the four aspects, we conducted the correlation analysis. The analysis results showed that these four aspects all have a significant correlation amongst each other, where the correlation of grit with efficacy and regulation is very small, as shown in table 2.

Table 2 Correlation analysis results

	M	SD	G1	G2	C11	C12	C2	C3	C4	C5	SRL1	SRL2	SRL3	SRL4	SRL5	SRL6
G1 Consistency of Interests	2.94	0.81	1													
G2 Perseverance of Effort	3.66	0.65	0.79	1												
C11 Communication Ways	4.02	0.75	0.92	0.59**	1											
C12 Communication Feels	3.84	0.64	-0.11	0.35**	0.41**	1										
C2 Collaboration	3.20	0.63	-0.06	0.38**	0.42**	0.54**	1									
C3 Critical thinking	3.60	0.61	-0.01	0.44**	0.22**	0.25**	0.44**	1								
C4 Complex problem solving	3.60	0.64	-0.25**	0.39**	0.17	0.41**	0.39**	0.31**	1							
C5 Creativity	3.96	0.76	-0.14	0.27**	0.20**	0.28**	0.27**	0.45**	0.26**	1						
SRL1 Target Setting	3.29	0.70	0.02	0.45**	0.53**	0.46**	0.45**	0.29**	0.53**	0.12	1					
SRL2 Environmental Construction	3.66	0.73	-0.17	0.48**	0.32**	0.38**	0.48**	0.29**	0.26**	0.19	0.41**	1				
SRL3 Task Strategies	2.79	0.85	0.01	0.40**	-0.05	0.21**	0.40**	0.29**	-0.46	0.10	0.27**	0.34**	1			
SRL4 Time Management	3.40	0.75	-0.29	0.44**	0.24**	0.22**	0.44**	0.31**	0.19	0.17	0.35**	0.45**	0.18	1		
SRL5 Help Seeking	3.53	0.74	-0.58	-0.38	-0.23**	0.17	-0.19	0.09	0.18	-0.18	0.28**	0.00	0.91	0.74	1	
SRL6 Self-Evaluation	3.42	0.68	-0.18	0.34**	0.17	0.50**	0.30**	0.21**	0.43**	0.18	0.49**	0.27**	0.19	0.24**	0.23**	1

e. Regression Analysis

Nowadays, more and more countries realize that students' core literacies such as communication, collaboration, critical thinking, complex problem solving and creativity are important (Hwang, Lai, Liang, Chu, & Tsai, 2017). Specifically in the field of education research discusses how to improve students' literacies (Bruin, & Merriënboer, 2017; ChihHsuan, David, & Margaret, 2013). However, currently research is focused on factors, such as the learning activities, teaching methods, teaching strategies and so on, that teachers adopt. Whilst recognizing the importance of these factors, students' own characteristics will also have an impact on their literacy development. Some studies (Wolters, &Hussain, 2015; Cho, Kim, & Choi, 2017) have shown that students' self-regulated learning ability and perseverance are two important characteristics and these also have an impact on their academic performance. The present study aims to explore whether students' self-regulated learning and grit will impact their 5C abilities development and to bridge the research gap with the previous studies. Through the regression analysis we found a model, as presented in table 3.

Table 3 Regression analysis results

		Non-standardized coefficient		Standardized coefficient	t	Sig.
		B	Standard Error	Trial Version		
C11	(constant)	3.15	0.46		6.84	0.00
	G2	0.40	0.11	0.35	3.80	0.00
	SRL5	-0.20	0.80	-0.22	-2.42	0.02
C12	(constant)	1.49	0.34		4.22	0.00
	SRL1	0.20	0.91	0.22	2.20	0.00
	SRL2	0.17	0.80	0.19	2.17	0.03
	SRL6	0.32	0.09	0.34	3.65	0.00
C2	(constant)	1.82	0.35		5.24	0.00
	G2	0.46	0.09	0.47	5.43	0.00
	SRL2	0.21	0.08	0.24	2.78	0.00
	SRL5	-0.12	0.06	-0.17	-2.19	0.03
C3	(constant)	2.02	0.33		6.16	0.00
	G2	0.43	0.88	0.44	4.88	0.00
C4	(constant)	2.64	0.34		7.81	0.00
	G2	0.30	0.08	0.32	3.56	0.00
	SRL1	0.42	0.07	0.48	5.72	0.00
	SRL3	-0.25	0.07	-0.30	-3.67	0.00
C5	(constant)	2.79	0.42		6.67	0.00
	G2	0.32	0.11	0.27	2.85	0.00
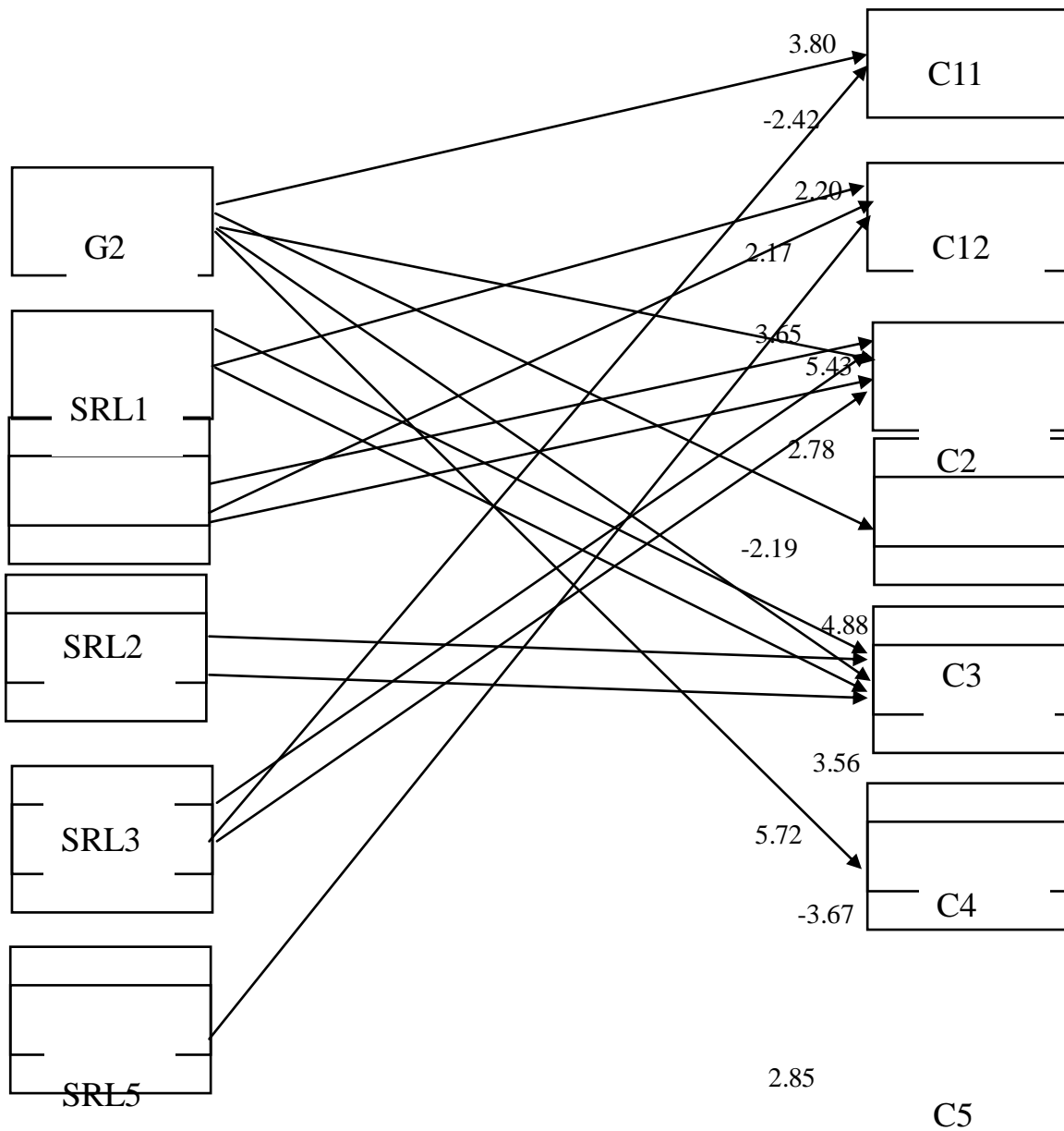
Discussion and Conclusion

(1)Communication can be subdivided into two sub-dimensions: communication ways and communication feeling.

When we explore the factors analysis (EFA), we found the dimension "communication" cannot be integrated into one factor. We have carefully studied the items under the "communication" dimension and found some items describing the way people communicate with others, such as "I try to be warm when communicating with others". While some items describe the feelings when someone talks with others, such as "While I'm talking, I think about how the other person feels".

The communication ways are considered from the perspective of the speaker. The speaker wants to make a good impression on others. The feeling during the communication is that the speaker fully considers the feelings of others, and then changes the way of communication, making the other person feel comfortable.

(2)Students' consistency of interests is not related to their self-regulated learning and 5C competences.

We usually think that when someone has a firm goal, one will adjust the learning style, and then work towards a goal to improve their own multi-faceted ability. With technology however, we need to constantly adjust our direction and plan. Interest is just a personal trait or goal for a period of time, which does not affect a person's usual way of doing things and their personal ability.

Our research found that students' consistency of interests is not related to their self-regulated learning and 5C competences. Therefore, we need to change our thinking, especially in China, which believes that only with a firm goal we can continue to make progress.

(3)The results of linear regression indicated that students' perseverance of effort could predict their 5C competences, and students' self-regulated learning; especially goal setting, environment structuring, task strategies, help seeking and self-evaluation all have a positive impact on their 5C competences.

Previous studies have explored that grit and self-regulated learning can effectively predict students' academic performance. We believe that the academic performance is just a formal expression of students. This study wants to verify whether perseverance and self-regulated learning can predict students' 5C abilities. So we use 5C as the dependent variable, while grit and self-regulated learning as an independent variable to explore their relationship.

From the result we find that students' perseverance of effort has a positive influence on 5C, although it is taken into account that people will meet some difficulties whilst trying to achieve their dream. The key is to never give up and learn from the way to growth. So, from this result, we learn that as teacher we should teach students not to give up easily, and encourage them to try their best. Teachers should also think how to organize teaching when they cultivate this quality with their students.

As for students' self-regulated learning, only "time management" cannot predict their 5C abilities. Other dimensions such as goal setting, environment structuring, task strategies, help seeking and self-evaluation are all positive impact their 5C competences. So this result suggests a more personalized approach. Teachers should guide students to set their own targets, choose the right place for them to learn well, choose suitable strategies to solve problems and when they meet difficulties they should know who to ask for help so that they can self-reflect and evaluate.

This research looked into students' characteristics, telling us how to cultivate students' 5C competences. Teachers and parents could get some ideas on how to teach their students and children. Whilst there are some limitations, first there are only 103 students participated in this research, with a future study to aim to collect data from a larger sample. Secondly, we collected data by self-reporting methods, which may lack objectivity. A future study could try some accurate measurement tools during the data collection process.

References

Barnard, L., Lan, W. Y., To, Y. M., Paton, V. O., & Lai, S. L. (2009). Measuring self-regulation in online and blended learning environments. The internet and higher education, 12(1), 1-6.

Bruin, A. B., & Merriënboer, J. J. (2017). Bridging cognitive load and self-regulated learning research: A complementary approach to contemporary issues in educational research. Learning and Instruction, 51, 1-9. https://doi.org/10.1016/j.learninstruc.2017.06.001

Chih Hsuan Wang, David M. Shannon, & Margaret E. Ross. (2013). Students' characteristics, self-regulated learning, technology self-efficacy, and course outcomes in online learning. Distance Education, 34(3), 302-323. https://doi.org/10.1080/01587919.2013.835779

Cho, M. H., Kim, Y., & Choi, D. H. (2017). The effect of self-regulated learning on college students' perceptions of community of inquiry and affective outcomes in online learning. Internet & Higher Education, 34, 10-17. https://doi.org/10.1016/j.iheduc.2017.04.001

Chuang, S. C., Lin, F. M., & Tsai, C. C. (2015). An exploration of the relationship between internet self-efficacy and sources of internet self-efficacy among taiwanese university students. Computers in Human Behavior, 48(C), 147-155. https://doi.org/10.1016/j.chb.2015.01.044

Eastin, M. S., & Larose, R. (2000). Internet self‐efficacy and the psychology of the digital divide. Journal of Computer‐mediated Communication, 6(1), 0-0.

Hwang, G. J., Lai, C. L., Liang, J. C., Chu, H. C., & Tsai, C. C. (2017). A long-term experiment to investigate the relationships between high school students' perceptions of mobile learning and peer interaction and higher-order thinking tendencies. Educational Technology Research & Development (6), 1-19. https://doi.org/10.1007/s11423-017-9540-3

Lim, D. H., & Kim, H. (2003). Motivation and learner characteristics affecting online learning and learning application. Journal of Educational Technology Systems, 31(4), 423-439.

Prior, D. D., Mazanov, J., Meacheam, D., Heaslip, G., & Hanson, J. (2016). Attitude, digital literacy and self efficacy: flow-on effects for online learning behavior. Internet & Higher Education, 29, 91-97. https://doi.org/10.1016/j.iheduc.2016.01.001

Wolters, C. A., &Hussain, M. (2015). Investigating grit and its relations with college students' self-regulated learning and academic achievement. Metacognition & Learning, 10(3), 293-311.

Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. Journal of educational psychology, 81(3), 329-339. https://doi.org/10.1037/0022-0663.81.3.329

Zimmerman, B. J., &Schunk, D. H. (2004). Self-regulating intellectual processes and outcomes: A social cognitive perspective. Motivation, emotion, and cognition: Integrative perspectives on intellectual functioning and development, 323-349.

GuotaoZ. (1995). The Theory of Self-regulated Learning——New Progress in Bandura's Learning Theory. Foreign Education Research, (3), 1-3.

Ministry of Education of People's Republic of China. (2010). National Development Plan for ICT in Education (2011-2020). Accessed March 2019 from http://old.moe.gov.cn//publicfiles/business/htmlfiles/moe/s5889/201204/134096.html.

Ministry of Education of People's Republic of China. (2010). National Medium and Long-term Education Reform and Development Plan. Online. Accessed March 2019 from http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/s3342/201203/xxgk_133322.html.

Appendix A

NO	Items	1	2	3	4	5
5C						
1	I try to make the other person feel good.					
2	I try to make the other person feel important.					
3	I try to be warm when communicating with others.					
4	While I'm talking I think about how the other person feels.					
5	I am verbally and nonverbally supportive of other people.					
6	I disclose at the same level that others disclose to me.					
7	I believe our team can cooperate successfully when I conduct collaborative learning.					
8	I try to provide useful and sufficient information when I conduct collaborative learning.					
9	I have good communication with my team members when I conduct collaborative learning.					
10	I can finish my work efficiently when I conduct collaborative learning.					
11	Work is split based on our abilities when I conduct collaborative learning.					
12	I ask myself periodically if I am meeting my goals.					
13	I consider several alternatives to a problem before I answer.					
14	I find myself pausing regularly to check my comprehension.					
15	I ask myself questions about how well I am doing once I finish a task.					
16	When facing problems, I believe I have the ability to solve them.					
17	I believe I can put effort into solving problems.					
18	I can solve problems that I have met before.					
19	I am willing to face problems and make an effort to solve them.					
20	I like to observe something I haven't seen before and understand it in detail.					
21	I like to try something new.					
22	I like to do something by myself.					
SRL						
1	I set standards for my assignments in online courses.					
2	I set short-term (daily or weekly) goals as well as long-term goals (monthly or for the semester).					
3	I keep a high standard for my learning in my online courses.					
4	I set goals to help me manage studying time for my online courses.					
5	I don't compromise the quality of my work because it is online.					
6	I choose the location where I study to avoid too much distraction.					
7	I find a comfortable place to study.					
8	I know where I can study most efficiently for online courses.					
9	I choose a time with few distractions for studying for my online courses.					
10	I try to take more thorough notes for my online courses because notes are even more important for learning online than in a regular classroom.					

11	I read aloud instructional materials posted online to fight against distractions.					
12	I prepare my questions before joining in the chat room and discussion.					
13	I work extra problems in my online courses in addition to the assigned ones to master the course content.					
14	I allocate extra studying time for my online courses because I know it is time-demanding.					
15	I try to schedule the same time every day or every week to study for my online courses, and I observe the schedule.					
16	Although we don't have to attend daily classes, I still try to distribute my studying time evenly across days.					
17	I find someone who is knowledgeable in course content so that I can consult with him or her when I need help.					
18	I share my problems with my classmates online so we know what we are struggling with and how to solve our problems.					
19	If needed, I try to meet my classmates face-to-face.					
20	I am persistent in getting help from the instructor through e-mail.					
21	I summarize my learning in online courses to examine my understanding of what I have learned.					
22	I ask myself a lot of questions about the course material when studying for an online course.					
23	I communicate with my classmates to find out how I am doing in my online classes.					
24	I communicate with my classmates to find out what I am learning that is different from what they are learning.					
GRIT						
1	I often set a goal but later choose to pursue a different one.					
2	New ideas and new projects sometimes distract me from previous ones.					
3	I become interested in new pursuits every few months.					
4	My interests change from year to year.					
5	I have been obsessed with a certain idea or project for a short time but later lost interest.					
6	I have difficulty maintaining my focus on projects that take more than a few months to complete.					
7	I have achieved a goal that took years of work.					
8	I have overcome setbacks to conquer an important challenge.					
9	I finish whatever I begin.					
10	Setbacks don't discourage me.					
11	I am a hard worker.					
12	I am diligent.					