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Full Length Research Paper

A scale development study for one of the 21st century skills: Collaboration at secondary schools

Serkan Boyraz

School of Foreign Languages, Aksaray University, Aksaray, Turkey.

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ABSTRACT

Collaboration skill has become one of the key skills in the 21st century both in education and work life. That is why educators need to learn about their students' preferences and readiness in collaboration in the classroom. This study aims to develop a scale that lets secondary school students self-evaluate their collaboration skills. To follow this aim, a general survey methodology was used. A draft scale consisting of 33 items was developed through the relevant literature and was examined by experts. Then, the draft version was applied to a total of 402 secondary school students at a state secondary school in Aksaray city in Turkey in the 2019-2020 academic year. The data was subjected to first explanatory then confirmatory factor analysis. The explanatory factor analysis and first and second stage confirmatory factor analysis results indicate that the Scale for Self-Evaluation of Collaboration Skills (SSCS) with 29 items under three sub-dimensions -namely affective considerations, collaboration process, and roles and responsibilities- is a valid and reliable tool to examine collaboration skills of secondary school students.

Keywords: 21st century skills, 4Cs in education, collaboration, scale development.

E-mail: serkan.boyraz@gmail.com.

INTRODUCTION

In the 21st century, it is not enough for students to only be competent in basic subjects such as reading, writing, science, and mathematics as some basic social and life skills such as taking care of themselves, interacting well with others, being interdependent and constantly improving over time and staying up to date to be independent are critical (Barkley et al., 2014). For example, as communication and collaboration skills provide students a chance to explain their ideas, exchange their thoughts, and help each other, they have been identified as mediating factors in supporting learning (Kafai, 2002). Besides, in today's global economy, together with the shift from a document-oriented working style to a people-oriented one, teamwork, together with communication skills, has become an important factor in the selection of managers. Therefore, in the 21st century economy, it is necessary to communicate in an effective way and work collaboratively with different groups of people. The Partnership for 21st Century Skills (P21) was founded in the USA in 2002 by a coalition of the US Department of Education and business and education leaders to identify the needs to better prepare students for 21st century careers and life developed a framework for 21st century learning. Since then, the coalition's vision has evolved to include and focus on critical thinking and problem-solving skills, communication and collaboration, and technology-related skills. In addition, for higher education and professional careers in the 21st century dominated by the digital economy, students must go beyond the basic criteria and 21st century skills -namely "creativity, communication, critical thinking and collaboration"- which are called "Century Super Skills" or "4Cs", should be embedded in the curriculum (Choirunnisa, Prabowo and Suryanti, 2018; Lippl, 2013; SBAC, 2015).

Hovious (2015: 14-15) explains that the 21st century learning model is a response to the demands of technology on work and life skills of the current age, but it still represents similar ideas in most educational research like Bloom (1956), Dewey (1910), Piaget (1928) and Vygotsky (1978). While many different frameworks have been created to define and categorize "21st century

skills", a common set of topics has emerged from an international comparative analysis by Voogt and Roblin (2012) such as collaboration, communication, ICT literacy, social/cultural competence, and most frameworks include creativity, critical thinking, productivity, and problem-solving (Hayes, 2016). In summary, these skills include three key areas of knowledge: (1) innovative thinking; (2) information, media, and ICT (information, communication, and technology) skills (collectively referred to as "digital literacy"); and (3) life and career skills (Chu et al., 2017).

According to the literature, small group work in the classroom provides several benefits such as creating energy for difficult tasks, capitalizing on members' changing assets, allowing for differentiated education, and increasing student achievement. A meta-analysis by Johnson and Johnson over more than 185 studies put forward that collaborative learning experiences "support higher individual achievement and greater group productivity than competitive/individual models" (Laughlin, 2014: 50-51). When students work in groups, communication and cooperation skills develop together (The National Center for Research on Evaluation, Standards and Student Testing, 2010).

Collaboration, the act of working together to achieve common goals, has become the trend of the current century as the need to think and work together on critical issues in society has triggered the shift from individual efforts to group work, from independence to social interaction. Collaboration is not just about students working in groups in the classroom; it also aims to foster the ability to socialize and control the ego and emotions. This skill increases the sense of togetherness and responsibility among the members of a group. It has characteristics such as showing the ability to work effectively and respectfully in different teams, demonstrating flexibility and willingness to put forth the necessary effort to achieve a common goal, taking joint responsibility for collaborative work, and valuing each team member's contributions (Handajani and Pratiwi, 2018). Flexibility and willingness to help are required in collaboration as students need to demonstrate the ability to work effectively and respectfully in different teams. Besides, it is necessary to provide joint responsibility for cooperation efforts and thus to value each team member (Smit, 2015: 7-8).

The role a person takes in a specific context of collaborative work will depend both on their collaborative skills and the roles and task demands of other team members. Roles might differ based on how much a person considers other people's perspectives, how much s/he allows these views and ideas to influence his ideas and processes, and how he uses honesty, tact, and diplomacy to handle minor and huge disputes. A collaborative task may not include all roles. There will likely be no need for coordination or conflict resolution when work only asks people to brainstorm and generate a large number of ideas, but no need to rank possibilities or make any decisions. In sum, the requirements that a task includes are important in the evaluation of collaborative performance (Lai et al., 2017).

Simply putting students into small groups and asking them to work with others in the group does not mean practicing or developing collaboration skills. Students need to develop their group dynamics, problem-solving processes, and interpersonal communication skills to collaborate effectively (Ananiadou and Claro, 2009). When the cooperation skill is examined holistically, the basic issues are working effectively and respectfully in different and diverse teams, being flexible and willing to make concessions to reach the common goal and sharing responsibilities and individual contributions in joint work are of equal importance (The National Center for Research on Evaluation, Standards, and Student Testing, 2010). Collaborative teams are made up of individuals who share several defining characteristics: (1) they have a common collective identity, (2) they have common goals, and (3) they are interdependent in terms of their assigned tasks or outcomes (Hughes and Jones, 2011). Slavin (1996) examined a number of empirical research on cooperative learning and discovered that group objectives, individual accountability, and group interaction are all important aspects in ensuring learning success. Song (2014) reviewed the methodological issues in Mobile Computer-Assisted Collaborative Learning research between 2000 and 2014 and found that there was an increased tendency to explore cooperative learning problems in an authentic learning environment but drew attention to the lack of tools to examine the cooperative learning process (Fu and Hwang, 2018).

Students must learn how to handle group dynamics, problem-solving procedures, and interpersonal connections in order to work effectively. Three types of communication abilities have been discovered to be particularly important while collaborating: Students in high-performing cooperation groups are more likely to offer explanations, ask questions, and engage in contentious debates than students in low-performing groups (Huang et al., 2010: 8). Sharing or comparing the information with an emphasis on first-level observation, agreement, reinforcement, explanation, and description are five stages of collaborative knowledge generation described by Schellens et al. (2005) that reflect individual contributions to team discourse.

The collaboration skill whose various definitions, features, function, and importance in education has been explained so far is standing among the four critical skills in 21st century education together with communication, critical thinking, and creativity. This leads the educators to the need to find out the collaboration skills of their students to manage the flow of the teaching and learning process better. As a result, this study aims to develop a valid and reliable scale for self-evaluation of collaboration

skills (SSCS) by secondary school students. Accordingly, the research question is formed as follows: Is SSCS a valid and reliable measurement tool?

METHODOLOGY

This study that aims to develop a valid and reliable scale for secondary school students to self-evaluate their collaboration skills has employed the general survey method. This method was preferred as it allows to determine the characteristics, thoughts, and attitudes of a universe (Hocaoğlu and Akkuş-Baysal, 2019: 78). The relevant literature was examined, and a draft version of the scale was formed with 33 items. After the expert opinions over the draft, the piloting process was carried out. Piloting was followed by exploratory factor analysis (EFA) which has three main uses (Field, 2018: 991): understanding the structure of a set of variables, reducing a data set to a more manageable size, and constructing a questionnaire to measure an underlying variable which fits the aim of the study. The factor structure model put forward by EFA was tested through confirmatory factor analysis (CFA) that is "used in a deductive mode (contrary to EFA that does the same but in an inductive way) to test hypotheses regarding unmeasured sources of variability responsible for the commonality among a set of scores" (Hoyle, 2000: 465).

Sample

The pilot study of the scale development process was carried out at a state secondary school included 450 students as the target group while the sample consisted of 402 students as some students were absent when piloting and some provided inappropriate returns that included missing answers to some items or same answer to all questions.

FINDINGS

In order to evaluate the suitability of the data set obtained in the pilot application for exploratory factor analysis (EFA), first of all, the results of the KMO Sampling Suitability Measurement and Barlett test were examined. KMO test results (.889) and Barlett test results ($p = .000$) were found to be significant. The KMO value higher than .7 indicates a strong partial correlation between items, while a significant Barlett test result ($p > .05$) indicates appropriate construct validity (Chen et al., 2016). Accordingly, the developed scale was suitable for EFA. As a result of EFA, it was seen that there were 10 factors with an eigen value above one and they explained 65.61% of the total variance. At this point, the scree-plot graph (Figure 1), which helps to reduce the number of factors by showing the dominant factors (Cokluk, Şekercioğlu and Büyüköztürk, 2012) was used.

The point where the downtrend starts to flatten on this graph is the cut-off point of the significant contribution to the variance and is important in deciding the number of factors. The number of points up to this point indicates the number of factors (Gorsuch, 1974; cited in Çokluk et al., 2012). Since flattening was observed from the fourth point indicated by the blue arrow, it was decided that the scale showed a three-factor structure, and the factor analysis was repeated accordingly. In the EFA, the factor loading value of the items is expected to be at least 0.40, and if the item is included in more than one factor, there should be at least a .10 difference between the factor loading values (Pituch and Stevens, 2016: 349). Four items in the draft scale were excluded from the analysis due to the difference of less than .10 between the item loadings in the two factors. The factor loadings of the items in the scale are given in Table 1.

As can be seen in Table 1, after 4 items were eliminated, factor loadings of the remaining 29 items in the three-factor structure ranged from .461 to .814. There are 10 items in the first sub-dimension of the scale which is named "affective considerations (AC)" as the items in this sub-dimension question students' feelings about collaboration in classwork. The second sub-dimension also has 10 items, and it is named "collaboration process (CP)" as the items here examine students' thoughts about how the collaboration process should take place. Lastly, the third sub-dimension includes 9 items and it is named "roles and responsibilities (RR)" here the common point is what roles and responsibilities the students attribute to themselves and their group members while working collaboratively. Values related to the explained variance of the scale are presented in Table 2.

As seen in Table 2, the total variance explained by the three-factor structure is 48.024%. In developing a scale specific to the field of social sciences, if the scale is multifactorial, it is considered sufficient when the explained variance is between 40% and 60% (Çokluk et al., 2012: 239). Accordingly, the total variance explained by the developed scale was accepted as sufficient.

After the construct validity analysis of the SSCS was completed, reliability analysis was carried out. The Cronbach alpha value of the first sub-dimension of the scale was .88. The Cronbach alpha value of the second sub-dimension is .87 and the Cronbach alpha value of the third sub-dimension is .82. The Cronbach alpha value of the whole scale is .82, and both sub-dimensions and overall scale are above the lower limit of .70 in terms of reliability. The correlation analysis was carried out then to examine the internal consistency and it was seen that all items in the scale had a significant correlation with the total score at the level of .01 (item-total correlation scores ranging from .42 to .69). The result of the independent t-test between the high and low 27% groups revealed a statistically significant discrimination index for each item.

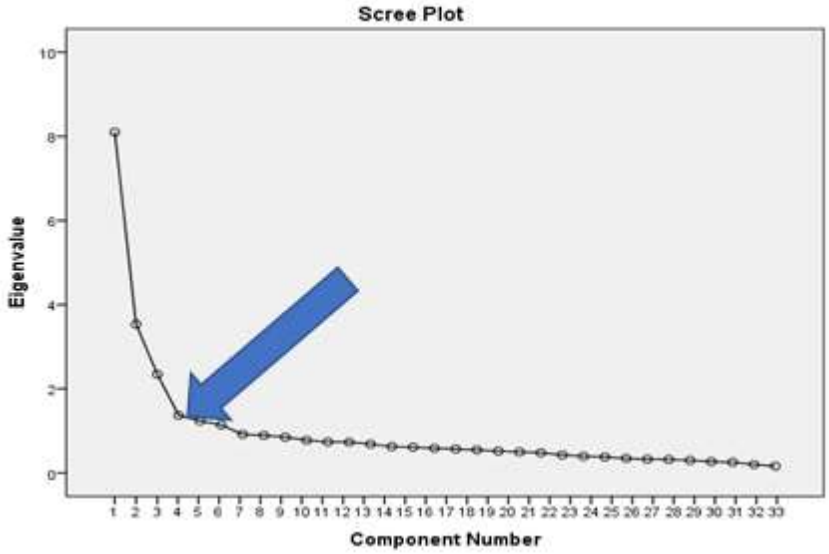

Figure 1. Scree plot of the collaboration scale.

Table 1. Rotated Component Matrix of SSCS.

	Components		
	1	**2**	**3**
Item 4*	.814		
Item 2	.766		
Item 3	.722		
Item 1	.706		
Item 15	.702		
Item 11	.695		
Item 26	.636		
Item 24	.617		
Item 12	.607		
Item 19	.527		
Item 7		.771	
Item 9		.749	
Item 8*		.737	
Item 10		.732	
Item 16		.717	
Item 27		.690	
Item 29		.649	
Item 28*		.609	
Item 17		.578	
Item 16		.482	
Item 5			.772
Item 6			.754
Item 13			.687
Item 14			.593
Item 23			.593
Item 29			.585
Item 25			.564
Item 18			.479
Item 20			.461

*Negative items.

Table 2. The explained total variance of the collaboration scale.

Factor	Initial Eigenvalues			Extractions sums of squared loadings			Rotation sums of squared loadings		
	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %
1	8.072	27.835	27.835	8.072	27.835	27.835	5.107	17.610	17.610
2	3.527	12.161	39.996	3.527	12.161	39.996	4.895	16.878	34.488
3	2.328	8.028	48.024	2.328	8.028	48.024	3.926	13.537	48.024

After the EFA and reliability analysis, Confirmatory Factor Analysis (CFA) was performed to confirm the construct validity. The results of this analysis are presented in Figure 2.

According to the results of CFA, the t values of the items explaining the observed variables are significant at the level of .01. When the error variances are controlled, it is seen that the error variances of all items are below .90 (Figure 2). Another point to be evaluated is the ratio of the Chi-square value (1317.30) to the degrees of freedom (374), and this ratio was calculated as 3.52. If this ratio is below five in large samples, it indicates a moderate level of harmony (Cokluk, Şekercioğlu and Büyüköztürk, 2012). Again, if the RMSEA value (.079) in the diagram is less than.10, it indicates a poor fit. According to the analysis results, GFI (.82) and AGFI (.79) are below .90, which corresponds to a good fit. Accordingly, it is seen that there is a weak agreement in terms of the relevant values. According to the results of the analysis, the RMR (.07) and standardized RMR (.06) values remain below the upper limit of a good fit, which is .08. Accordingly, RMR and standardized RMR indicate good agreement. As another criterion, NNFI and CFI fit indices were examined, and their being above .90 corresponds to a good fit. NNFI value (.91) and CFI value (.92) reveal a good fit. After the first stage CFA analysis was completed, the second level CFA analysis was performed and the results are given in Figure 3.

According to the results of the second level CFA, the t values of the items explaining the observed variables are significant at the level of .01. When error variances are controlled, it is seen that variance values of all items are below .90 (Figure 3). Another point to be evaluated is the ratio of the Chi-square value (1317.30) to the degrees of freedom (374), and this ratio was calculated as 3.52. A ratio of less than five in large samples indicates a good fit. Again, if the RMSEA value in the diagram (.079) is less than .05, it indicates perfect fit, and less than .08 indicates a good fit (Cokluk, Şekercioğlu and Büyüköztürk, 2012: 330). According to the analysis results, GFI (.82) and AGFI (.79) are below .90, which corresponds to a good fit. Accordingly, it is seen that there is a weak agreement in terms of the relevant values. According to the results of the analysis, the RMR (.07) and standardized RMR (.06) values remain below the upper limit of a good fit, which is .08. Accordingly,

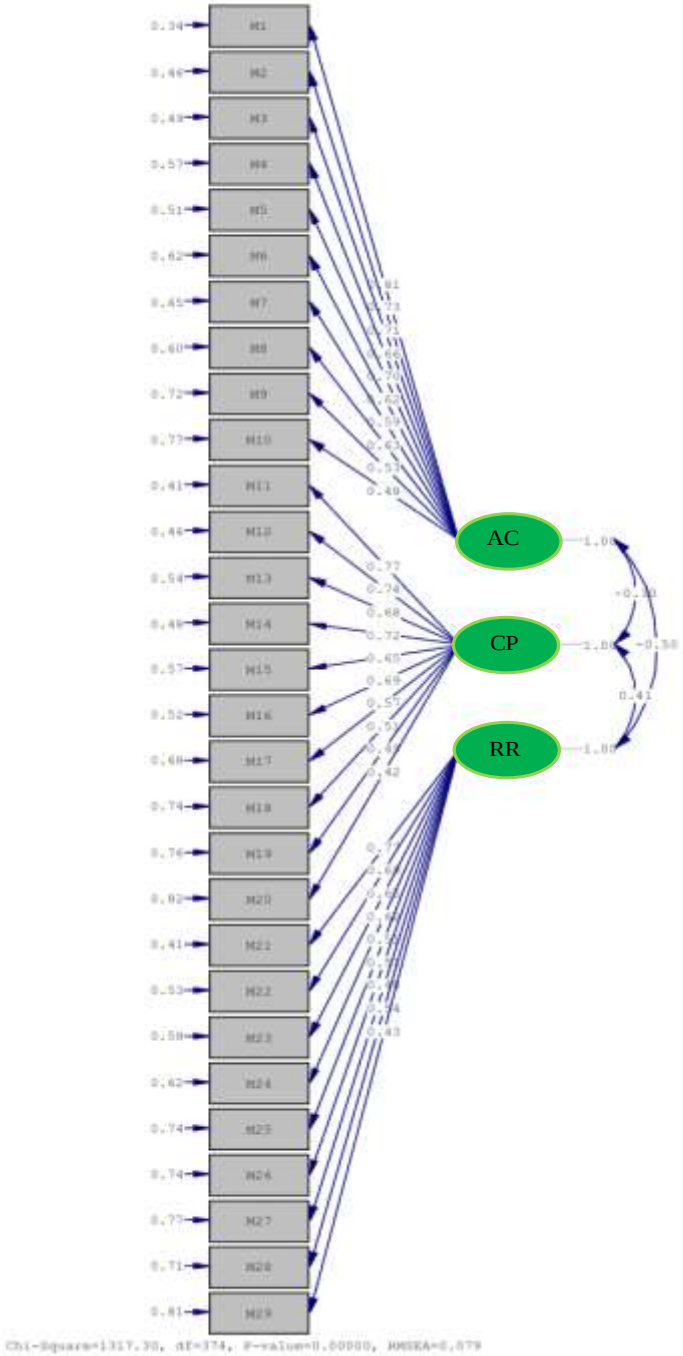

Figure 2. Path diagram of the first stage CFA of the scale.

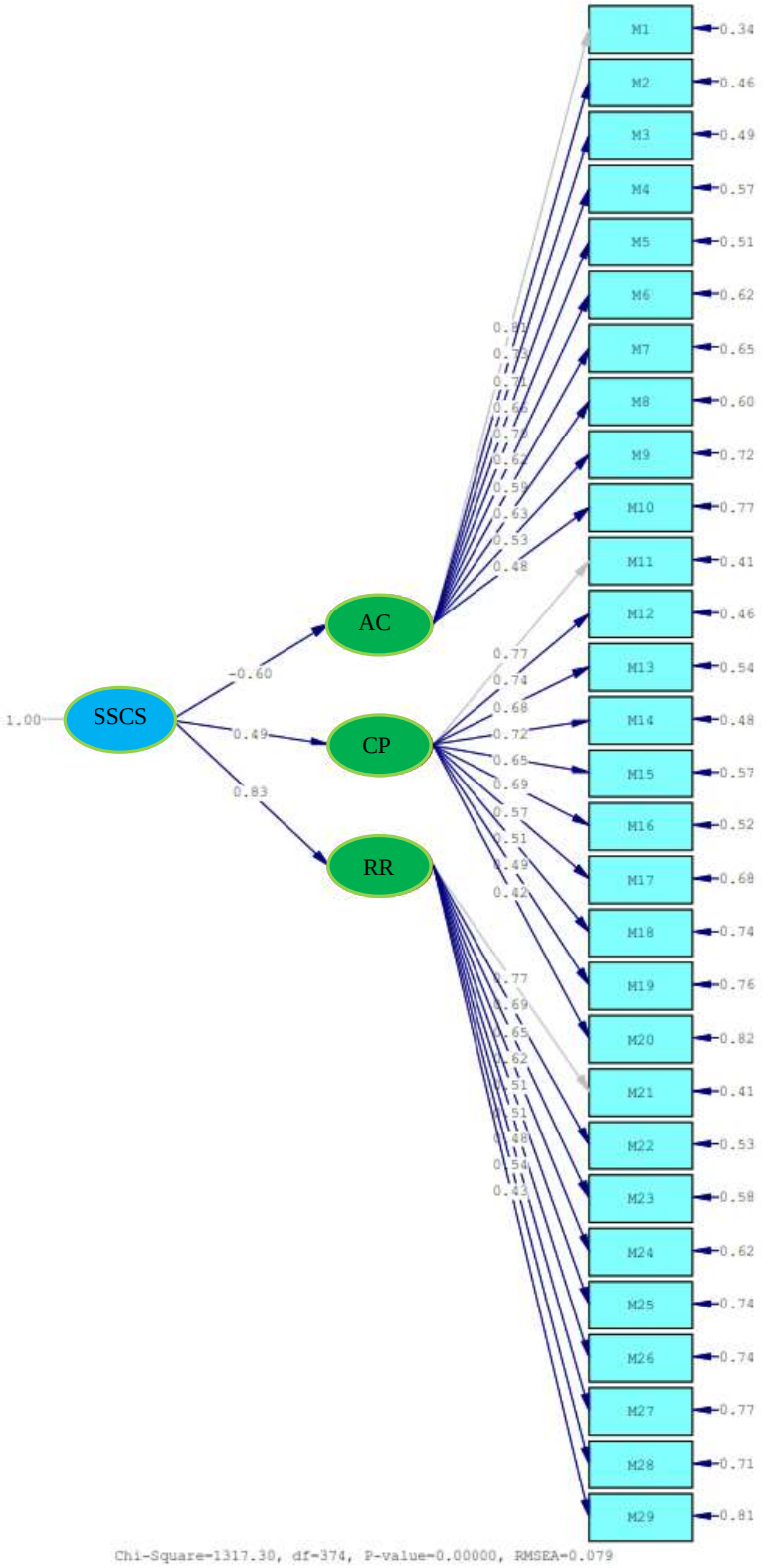

Figure 3. Path diagram of the second stage CFA of the scale.

RMR indicates weak, standardized RMR indicates a good fit. As another criterion, NNFI and CFI fit indices were examined, and their being above .90 corresponds to a good fit. NNFI value (.91) and CFI value (.92) reveal a

good fit.

CONCLUSION

The education today requires many skills more than simply reading and writing and collaboration skill is one of them as the work-life also demands people to think and produce together. As this skill has become so important lately, this study tries to provide educators with a valid and reliable scale for self-evaluation of collaboration skills (SSCS) for secondary school students. The final version of the scale consists of 29 items under three sub-dimensions, namely affective considerations, collaboration process, and roles and responsibilities. The higher score indicates a higher tendency towards collaboration while a lower score represents the opposite. The educators can use the SSCS to learn about their students' readiness for collaboration in class practices and shape the teaching and learning process accordingly.

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