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MEASURING ROLE MODELING PERCEPTIONS OF SECONDARY SCHOOL STUDENTS: FACTOR STRUCTURE AND RELIABILITY OF SCALE[1]

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Abstract: The research aims to develop a valid and reliable scale to determine secondary school students' perceptions of role modeling. The survey design model, which is a quantitative research method, was used in the research. The study's sample comprised 500 students enrolled in three secondary schools in Turkey during the 2018 spring semester. Data for confirmatory factor analysis were collected using the draft scale administered to 308 students across all levels of a secondary school in Turkey, in contrast to the sample utilized in the exploratory factor analysis during the 2018-2019 academic year. A literature review was conducted to ensure content validity, followed by the creation of a question pool that was evaluated by experts, and an analysis of item indexes was performed. Factor analyses, both exploratory and confirmatory, were performed to verify construct validity. As a result of the reliability analysis, the Role Modeling Perceptions Scale consisting of 30 questions and three factors explaining 41.96% of the variance was obtained, and the reliability coefficient was found to be .91 (Cronbach alpha coefficients of factors; reproduction .88; retention .84; motivation .75). This scale can be used to determine students' role-modeling perception levels.

Keywords: Social cognitive theory, role model, science education, scale development, validity, reliability

1. Introduction

Social cognitive learning theory involves triadic reciprocal determinism and views individuals as having an interactive role rather than a passive one. Constant interactions occur between an individual and their social environment. Another situation as important as the social environment of the individual is the individual's perception of that social environment. The potential environment turns into an active environment based on people's behaviors. Although the potential environment is the same for every person, the active or perceived environment depends on behavior (Bandura, 1989). In other words, the meanings of the physical environment for an individual and the individual's perceptions of the physical environment have more important effects on the individual than changes in the physical environment. This state of cognitive interaction is a purposeful action. The individual tries to integrate the stimuli into cognitive elements instead of giving automatic responses to the stimuli around them. The social cognitive theory views this behavior not as an automatic response but as a product of thought. This dynamic relationship between an individual and their social environment is explained through the principle of triple reciprocity (Celen, 1999, p. 114).

According to Bandura's (1989) social cognitive theory, the environment affects behavior, and behavior also affects the environment. For example, the behavior of a rude person in society can result in an environment of high punishment and low reward. On the other hand, the behavior of a kind and friendly person in the same social environment may create an environment with low punishment and high reward. In these examples, individual behavior has changed the environment. The real environment one creates as a result of one's behavior differs for individuals in the same potential social environment. In other words, Bandura stated that humans create negative conditions as well as opportunities (Burger, 2006, p. 531). People tend to shape the social environment in which they live by constantly running away from something or by pursuing something and taking advantage of their

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learned expectations. According to Bandura, how an individual perceives the social environment is an intermediate variable between stimulus and response in learning. According to social cognitive theory, people do not react directly to a stimulus; they first decide what to do by interpreting the situation they are in and observing (Celen, 1999, pp. 114–116).

Bandura argued that people perceive the world symbolically through cognitive representations. Humans have the power to think and use language, and in this way can remember the past and represent the future in their minds. For the individual who learns by observing every event around them, the environment one perceives with the sense organs is transformed into images, and the images are transformed into mental symbols; this process constitutes the basic principles of learning. In other words, learning is the process of oscillating between reality and symbolization (Bandura, 1986).

Most behaviors are too complex to be learned through slow processes such as reinforcement and punishment. In his chapter on language development, Bandura emphasizes that in the process of children learning to speak, we do not reinforce everything they say (Bandura, 1977).

"Young children with limited language skills do not adopt modeled linguistic features for verbal approval alone" Bandura wrote in his chapter explaining language development (Bandura, 1977, p. 178). In this example, children learn to speak by observing others and paying attention to what behavior might lead to rewards (Avanozoglu Kiziltepe, 2007, p. 152).

Indirect learning indicates that people can learn by observing others as well as learning through direct experience. Indirect learning is significant as it facilitates the acquisition of certain behavioral patterns, thereby circumventing protracted trial-and-error phases and substantial errors. Furthermore, an individual's ability for indirect learning allows them to explore novel circumstances and activities to acquire information that would typically be inaccessible owing to constraints of time, resources, and space. For example, television has greatly increased the proportion of patterns and behaviors that people interact with every day, causing people to go beyond the limits of their environment (Brown, 1999). With technological developments, the Internet and social media have been added to these interaction circles; borders have disappeared, and the social environment opportunities that can increase individuals' indirect learning have also increased. In addition, the opportunities learners must learn by observing or modeling, which form the basis for their indirect learning, have also increased.

According to Bandura, many behaviors occur by observing and modeling what others do. Whether the model exhibiting a certain behavior is a real person (live model), a character in mass media (symbolic model), or explanations on how to behave (verbal directives), many behaviors can be somewhat learned through modeling (Rutledge, 2000). For effective modeling to take place, four processes must be used well: attention to the model (attentional processes), retention processes, the capacity to reproduce observed behaviors (motoric reproduction processes), and having the motivation to reproduce these behaviors (Bandura, 1971; Malone, 2002; Rutledge, 2000). Not every behavior learned by modeling or observing can be translated into performance. The reason why some of the behaviors learned by observing are preferred over others is about expectations, the predictions about what the result will be when performing a behavior.

The most important element of observational learning theory is the model. For people to learn a behavior, they need to see how others perform that behavior. Character similarities (i.e., similarities between the model's and observer's qualities) increase the likelihood of imitating behavior. As a result, basic qualities such as age, gender, character, resemblance, and status should be considered in the model-observer interactions. The more similar the features of the model are to those of the observer, the more the observer exhibits behaviors similar to those of the model (Kaya et al., 2007, pp. 428-429). In other words, the individual chooses the ideal model for the behavior they want to learn, and at this stage, the concept of role models comes to the fore. When considering that the learning adventure continues throughout life, one can say that out-of-school learning situations are as important as in-school learning. In this case, individuals who are conscious of learning by modeling and who know what information, from which source, when, how, and how much they need to learn will have an advantage in this adventure.

Considering the ability to learn how to learn only as an individual struggle would be incorrect perhaps because the most important part of learning to learn is guidance support. The concept of learning to

learn has been determined as one of the key concepts that individuals will need on different platforms throughout their lives in the Turkish Qualifications Framework (Ministry of National Education (MoNE), 2018). Put more clearly, seeking and benefiting from guidance support is as important as gaining, processing, and internalizing new knowledge and skills. In this context, the learner's orientation to the right resource brings to mind the concept of role models. Individuals with good perceptions of role modeling are also individuals with high awareness who know where, when, and how to get help and who rarely make random spur-of-the-moment choices. In other words, the concept of role modeling is among the necessary competencies for education and directly serves the aims of education. As such, the concept of role modeling is important in many disciplines, and one of these educational fields is science education. We can say that learning from role models is a concept that makes positive contributions to science education and is intertwined with it in this respect.

The rapid change in science and technology directly affects individual and social needs, priorities, expectations, and roles. Accordingly, the individual is expected to have qualities such as producing information, transferring it to daily life and using it functionally, problem-solving skills, critical thinking capacity, ability to control his learning, empathy and communication skills, researching the source of information, and using the right source correctly (MoNE, 2018). In addition, "improving career awareness and entrepreneurship skills related to science" is among the main objectives of the Science Curriculum. Should Turkey achieve its national targets, it will have the opportunity to align with worldwide standards in science education. The more qualified people that students can emulate, the more likely we will be to achieve Turkey's educational goals. Thanks to good role models with careers in science and entrepreneurship, education will not only be limited to school hours, but the advantages of lifelong learning will be used. Thus, students' learning from role models will not only be limited to in-school but will also continue in out-of-school environments. Therefore, students will acquire the skills targeted by science education more easily.

In terms of social learning, the learner needs to choose the right role model as well as to perceive the model correctly. According to Bandura, many psychosocial factors exist that affect the individual's perceptions when choosing a role model. Conditions such as prestige level, social status, and psychological state of the person selected as a role model as well as what has been obtained as a result of previous experiences, reinforcements, and motivation levels are effective in determining perceptions of role modeling (Aydin, 2003). Learners with a developed perception of role modeling prefer individuals who can lead, guide, and assist them, especially in the process of achieving their academically determined goals. While making this choice, they display a very conscious behavior and attitude that is far removed from coincidence or randomness because they are aware that the role model, they've chosen has an unusual effect on the importance given to one's career, the desire to become more educated, and the choice of profession (Hackett et al., 1989).

A good perception of role modeling allows one to realize that not all the characteristics of the individual selected as a role model can always be approved. In other words, for the observer to approve and implement the behavior the chosen role model exhibits, the behavior must be appropriate for both the observer's structure and goals (Kucukibis, 2016). In other words, the individual does not have to approve every behavior of the role model. After critically evaluating the behavior, the individual has observed concerning their criteria, they decide whether to take that behavior as an example or not. The data obtained here will be a good starting point and will prepare the groundwork for future research on determining, developing, and improving individuals' perceptions of role modeling.

Studies in which the concept of role models has been preferred as a research topic are seen to be based on a very different and broad perspective. In this context, studies on the role of any person, group, or hero in the work primarily stand out as an example for individuals (Bilis, 2012; Kaya, 2012; Soycan, 2018; Ugur, 2019; Yildirim, 2019). These studies are generally seen to be in the field of religion, morality, values, education, or literature. In this context, because the concept of role modeling is one with a broad perspective used in different fields, limiting the research area and clarifying the study will be important. As is known, learning by modeling is one of the basic concepts of social cognitive theory. Individuals tend to learn more from role models of their choosing from their close and distant social environment. Consequently, the notion of role models holds significant importance within social

cognitive theory. The training aims to enable all students to become leaders and representatives in their communities, equipped with academic and lifelong learning abilities. In this instance, assessing pupils' opinions of role modeling becomes paramount. Secondary school pupils can be effectively mentored by role models in accordance with the objectives of national education. How can we ascertain if role models are effectively guiding middle school students? The literature indicates a lack of a scale grounded in the concept of role modeling within science education that is sufficiently comprehensible for secondary school pupils. This research aims to provide psychometric data regarding the "Role Modeling Perception Scale," a novel measurement tool designed to evaluate middle school students' views of role modeling. In accordance with the previously cited research, this scale was created to evaluate perceptions of role modeling.

2. Method

2. 1. Research Design

The study used a survey design, a quantitative research methodology. A survey design encompasses quantitative research methodologies employed by researchers on a sample to delineate the attitudes, beliefs, behaviors, or attributes of a community (Fraenkel et al., 2012). The present study has opted for a survey to build a scale based on secondary school students' perceptions of role modeling.

2. 2. Population and Sample

The target population of this study is all secondary school students studying in Kayseri Province's Melikgazi District, Turkey. The accessible population is the secondary school students in the Melikgazi District's 3rd 5th, and 7th regions. The sample selected from the accessible population has been determined using cluster sampling, a type of random sampling. According to Kline (2005), the sample size was determined by adhering to the rule of 10% of the accessible population and 10 times the number of items in the quantitative data collection tool. In this context, the sample of the research for the item indices and Exploratory Factor Analysis (EFA) is made up of 500 students (125 5th graders, 132 6th graders, 127 7th graders, and 116 8th graders) studying in three secondary schools in Kayseri Province's Melikgazi District during the 2018 spring semester. To obtain data for the Confirmatory Factor Analysis (CFA), a 30-item Role Model Perception Scale was applied to a total of 308 students studying at each level of a secondary school different from the sample used in the EFA from the 7th region of Melikgazi during the 2018-2019 school year. Since the authors aimed to develop a data collection tool, they explained the data collection tool, data analysis, and data collection processes in detail in the findings section in order not to write the same things repeatedly.

3. Findings

3. 1. Population and Sample

Validity refers to how accurately a method measures what is intended to be measured. Having highly valid results from a study means they meet the real characteristics and differences present in the physical/social world (Fraenkel et al., 2012). Examining the content validity, index analyses, and construct validity is recommended to ensure internal validity, which involves the degree to which the observed and measured features among the variables can be explained (Buyukozturk et al., 2008).

3.1.1. Content Validity Findings. The first author conducted a literature review to evaluate national and international studies on the concept of role modeling for content validity. The research was conducted using the keywords role model, role modeling, and role modeling perception in databases such as ERIC and Google Scholar. Consequently, this review revealed the absence of a scale specifically designed to assess perceptions of role modeling. As we mentioned in the introduction, we identified a lack of literature specific to the field of science education, as the concept of role models is used in different fields. We created particular items considering models specific to science education, based on social cognitive theory, and representing the immediate environment in which secondary

school children can observe. For this reason, scale items were created by taking into account the modeling processes (attention, retention, reproduction, motivation) and definitions (Malone, 2002; Rutledge, 2000) of both the concept of role modeling and Bandura's (1971) social learning theory.

Items for the Role Modeling Perceptions Scale are developed based on influences from one's environment, including peers, parents, science educators, friends, siblings, and celebrities such as artists, writers, and actors. While role models in one's close social surroundings (e.g., family, relatives, teachers) affect the individual's behaviors, role models in mass media, cultural institutions, and other distant social environments (e.g., celebrities) also affect the individual's behaviors. When it comes to learning new, productive ways of thinking and behaving, peer groups play a crucial role (Wiener, 2006). Arranging the dimensions of the draft scale, whose theoretical foundation is based on Bandura's (1971) social learning theory, in such a way as to include attention, retention, reproduction, and motivation is predicted to be conceptually appropriate (see Table 1). The authors used the item numbers of the draft scale throughout the article to make the analysis clearer and more understandable. In other words, these factors and their associated items reflect the preliminary draft scale before the study. The items we developed at our scale could be placed under different dimensions (See Table 5).

Table 1 indicates that utilizing Bandura's (1971) modeling processes as the primary criterion for assessing perceptions of role modeling is suitable for the study's objectives. Furthermore, the terms representing Bandura's (1971) modeling processes within the item contents are highlighted in bold to clarify the rationale for an item's placement within a specific dimension. Negative items are denoted by a (-) symbol. The scale items, while tailored to science education, possess applicability across various fields. The authors incorporated terms like science teacher to facilitate response accuracy among middle school students for certain items. We included the science teacher in the statement "I appreciate when my science teacher notes important things about me to find a solution to a problem" to account for the fact that middle school students typically have multiple teachers. The student may encounter confusion regarding which teacher to consider when formulating their response to this question. To mitigate this confusion, we incorporated statements pertaining to science education into the items. The authors' backgrounds as science educators effectively contributed to the provision of relevant examples from this field.

Table 1. *Factors and Items from the Draft Version of the Role Modeling Scale Based on Modeling Processes*

Bandura's Modeling Processes	Suggestions for questions about the perception of role modeling
Attention (8 items)	21. My parents' pre-shopping list draws my attention.
	12. The simultaneous application with the instruction given by my science teacher beforehand draws my attention.
	8. My friends' study by summarizing in science class attracts my attention.
	19. It doesn't catch my attention that my siblings have access to sufficient sources for information they may need. (-)
	5. It draws my attention that a famous person (artist, athlete, etc.) makes the same mistake over and over in a series of films.
	26. It draws my attention that my parents organize their environment according to the work they do.
	46. It draws my attention that my science teacher checks the course instructions again after the unit is over.
	42. I notice that my friends ask each other what they do not understand in science class.
Retention (10 items)	9. I like that my siblings make frequent arrangements in their daily lives when their plans are disrupted.
	36. I don't particularly appreciate it when my parents review their work. (-)
	37. I like that my science teacher makes short repetitions at the end of the subject.
	38. I find it pointless for my friends to try to memorize the subject in science class. (-)
	39. I like it when my siblings repeat while studying.
	45. I don't like when my parents reconsider their preparations when guests come. (-)
	47. I find it unnecessary for my friends to re-study the tests they have solved in science class. (-)
	48. I appreciate my siblings reviewing relevant resources in preparation for an exam.

	49. I love it when a vocal artist reviews their repertoire before a concert.
	32. Knowing what punishment my science teacher will impose on what behavior gives me relief.
Reproduction (13 items)	1. I like it when my parents learn from their past mistakes.
	2. I think that my science teacher evaluates herself objectively in her profession.
	3. I care about my friends' self-criticism about the science course.
	4. I do not think that my siblings (brother, sister, younger brother) make an objective assessment about a subject related to them. (-)
	6. I don't like my parents making regulations before doing an event. (-)
	7. I dislike my science teacher drawing a unit-specific diagram before explaining the subject. (-)
	10. I like it when a famous person starts editing a new project.
	11. It bothers me that my parents set goals in all areas of life. (-)
	14. I like that my siblings use time effectively in every new plan they make.
	15. I love it when an actor completes the project she's aiming for in her movies.
	33. My friends' inconsistent behavior in science class bothers me. (-)
	28. I take as an example the way my friends regulate their science study environment according to themselves.
	34. I appreciate the imagination my siblings put into correcting their failures.
Motivation (18 items)	16. I like that my parents use different media (library, internet, etc.) to access information.
	17. I don't like when my science teacher comes to class with different resources. (-)
	18. I appreciate that my friends benefit from a variety of resources while they are studying their science courses.
	20. I appreciate the fact that a movie actor accesses information from different sources while writing the script for her/his new movie.
	22. I appreciate my science teacher taking notes about important things about me to find a solution to a problem.
	23. I find it unnecessary for my friends to make an effort about a concept that they cannot learn in science class. (-)
	24. I love that my siblings learn from the discussions between us.
	25. I don't like when a famous person takes notes on questions asked at a press conference. (-)
	13. I find it unnecessary for my friends to start studying for the science exam two weeks in advance. (-)
	27. I like that my science teacher organizes the class according to the subject.
	29. I don't like my siblings being disorganized in their home life. (-)
	30. In the series I follow, I don't care about the actors' arrangement of the working environment. (-)
	31. I like it when my parents reward me for my behavior.
	35. I find it unnecessary for celebrities to be rewarded for their achievements. (-)
	40. I love that my mother gets help from my father in things that she cannot do.
	41. I do not appreciate my science teacher getting help from other teachers in activities. (-)
	43. I appreciate my siblings helping each other with things they couldn't do.
	44. I don't mind when celebrities support each other on a project. (-)

The prepared draft form of the Role Modeling Perceptions Scale was applied to 500 secondary school students. The data resulting from the application were checked for completeness and objectivity. We checked for objectivity by comparing a participant's responses to positive and negative items expressing the same situations in the scale. Then entered into the SPSS.20 package program to conduct validity and reliability studies. After the data entry was completed, it was decided to assign the average value of each blank item to the relevant item, since the missing data constituted less than 5% of the entered data; the reverse coded items (Items 2, 6, 17, 18, 23, 26, 27, 28, 29, 31, 34, 35, 37, 39, 41, 43, and 46) from the scale were also recoded. All the items from the raw data prepared for analysis were determined to have a normal distribution. Cronbach's alpha of reliability for this draft scale was calculated as .91. When examining the results of the reliability analysis for each item (corrected item-total correlations), the reliability values for Items 37 (-0.14), 39 (-0.04), and 48 (-0.36) were found to be negative. When examining Cronbach's alpha of reliability when deleting these items, the reliability of the scale increased. For this reason, these three items (Items 37, 39, 48) were excluded from the scale. Again, the reliability values for Items 6 (.25), 17 (.29), 32 (.27), and 44 (.26)

were seen to be barely below .30. Removing items whose Cronbach's alpha values are less than .30 from a scale whose overall reliability is less than .70 is known to be important to increase the total reliability of the scale (Pallant, 2020, p. 116). Removing these four items (Items 6, 17, 32, 44) did not increase the reliability of the scale; because the reliability of the scale was already greater than .70, the decision was made to keep these items on the scale. The discrimination index values were found to be -0.04 for Item 37, 0.18 for Item 39, and -0.13 for Item 48, and these items were removed from the scale because of having low/negative distinctiveness values.

3.1.2. Construct Validity Findings. The KMO value was determined within the framework of construct validity.92. This value signifies that the sample is enough for doing factor analysis (Pallant, 2020, p. 200). The initial EFA conducted without factor constraints yielded extraction values for Items 2 and 46 below .30; Items 14, 21, and 28 exhibited overlap, resulting in the identification of six significant factors. The authors conducted the second-factor analysis by limiting the items to four factors. Thus, the authors found that items 7, 22, 32, 40, and 44 had low extraction values and item 17 was cross-loading. As a result of repeated trials, Items 3, 6, 31, 32, 34, and 38 were seen to overlap; as such, they were removed from the scale and the analysis continued. Finally, the decision was made to limit the number of factors to three and continue the factor analysis. The authors interpreted that the sample had a sufficient size, as they obtained a KMO value of .93 in the study after the items were removed (Secer, 2017). Statistically significant Bartlett values also support the assumption that the data provide a multivariate normal distribution. After checking the KMO value, the factor analysis was continued with the remaining items, and these were determined to be grouped under three significant factors. When examining the distribution of the items to the factors using the direct Oblimin vertical rotation technique, all the items were seen to have acceptable load values for the factor in which they'd been entered (the lowest item load value was .39 and the highest .72; see Table 3). The scree plot graph for these factors is given in Figure 1.

Table 2. *Total Explained Variance for the Role Modeling Perceptions Scale*

Initial Eigen Values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
9.03	30.09	30.09	9.03	30.09	30.09	5.00	16.67	16.67
2.20	7.34	37.43	2.20	7.34	37.43	4.49	14.95	31.62
1.36	4.53	41.96	1.36	4.53	41.96	3.10	10.34	41.96
1.17	3.90	45.86						
1.12	3.75	49.61						
1.00	3.33	52.94						
.95	3.16	56.11						
.91	3.03	59.14						
.83	2.76	61.89						
.80	2.68	64.57						
.77	2.58	67.15						
.75	2,48	69,63						
.74	2,45	72,08						
.70	2.34	74.42						
.69	2.32	76.74						
.63	2.10	78.84						
.61	2.03	80.87						
.58	1.94	82.81						
.54	1.81	84.61						
.53	1.77	86.38						
.49	1.66	88.04						
.48	1.59	89.64						
.47	1.58	91.22						
.46	1.52	92.74						
.44	1.46	94.20						

.40	1.35	95.55						
.37	1.22	96.77						
.35	1.18	97.95						
.33	1.11	99.05						
.29	.950	100.00						

Table 3. *Pattern Matrix Values for the Role Modeling Perceptions Scale*

Item Number	Pattern Matrix Values		
	1	2	3
Item 30	.72		
Item 13	.71	.31	
Item 10	.69		
Item 5	.66		
Item 20	.62	.31	
Item 16	.57		
Item 45	.57		
Item 24	.55	.35	
Item 1	.53		
Item 42	.45		
Item 33	.42		
Item 47	.41		
Item 25		.67	
Item 9		.65	
Item 12		.64	
Item 15		.59	
Item 49		.58	
Item 36		.57	
Item 11		.53	
Item 8	.30	.52	
Item 4	.30	.49	
Item 19		.43	
Item 41			.69
Item 29			.68
Item 35			.68
Item 18			.64
Item 26			.57
Item 43			.50
Item 23			.39
Item 27			.39

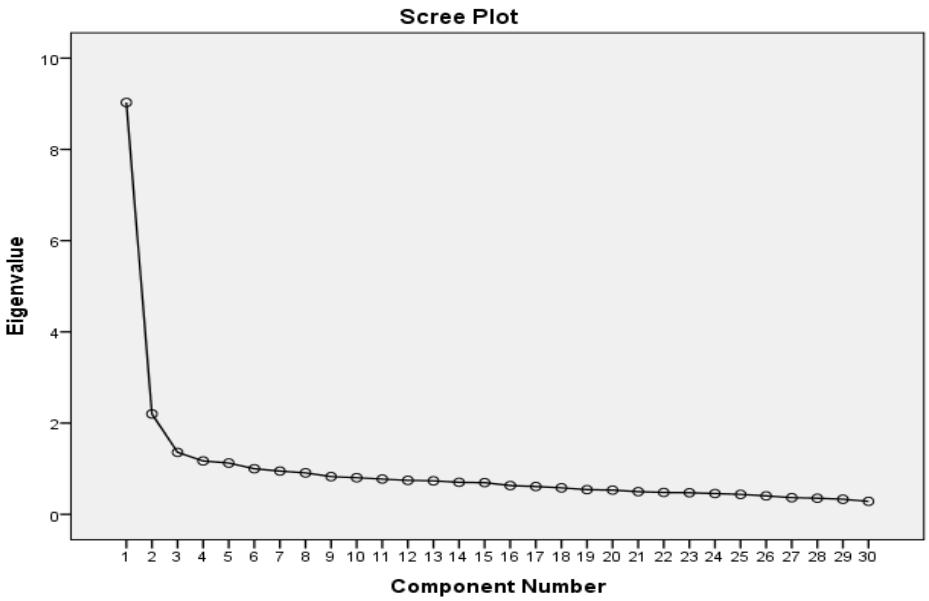

Figure 1. *Scree plot for the Role Modeling Perceptions Scale*

While preparing the item for the Role Modeling Perceptions Scale, four basic factors covering Bandura's (1971) modeling processes were initially predicted; however, three significant factors were determined as a result of factor analyses carried out nine times. In this context, the items predicted at the beginning were seen not to remain in the relevant factors but to be distributed into three significant factors in their final form. The authors reexamined the item contents of the three significant factors and renamed the items based on the predominant theoretical dimension. The scattering of items associated with the initially predicted factors can be interpreted as a result of the use of dimensions that theoretically represent closely related situations. A cyclical relationship exists among Bandura's four basic factors, which secondary school students have not yet distinguished.

Confirmatory Factor Analysis (CFA) was conducted utilizing LISREL 8.80 to statistically validate the results of the Exploratory Factor Analysis (EFA). Before implementing the scale to a second sample, the 30 items retained from the factor analyses were renumbered. To enhance comprehensibility, the current items are reported using the original numbering system. The Role Modeling Perceptions Scale was administered to 308 students from a secondary school distinct from that utilized in the EFA analyses to gather data for the CFA. After manually checking whether the raw data from the scales had been filled in completely and objectively, they were transferred to a computer. The items in the scale were grouped according to the factors determined as a result of the exploratory factor analyses, and syntax commands were written and made suitable for CFA. Analysis and interpretation of the model continued, as no situations had been indicated with a red arrow in the t values obtained as a result of the CFA (Secer, 2017, p. 186).

Figure 2 illustrates that Factor 1 pertains to reproduction, Factor 2 relates to retention, and Factor 3 signifies motivation. Secondly, in the context of CFA, it is essential to verify that the factor loading values for each item are at least .30 (Secer, 2017, p. 188). Figure 2 reveals that the factor loading values for all items are greater than or equal to .30.

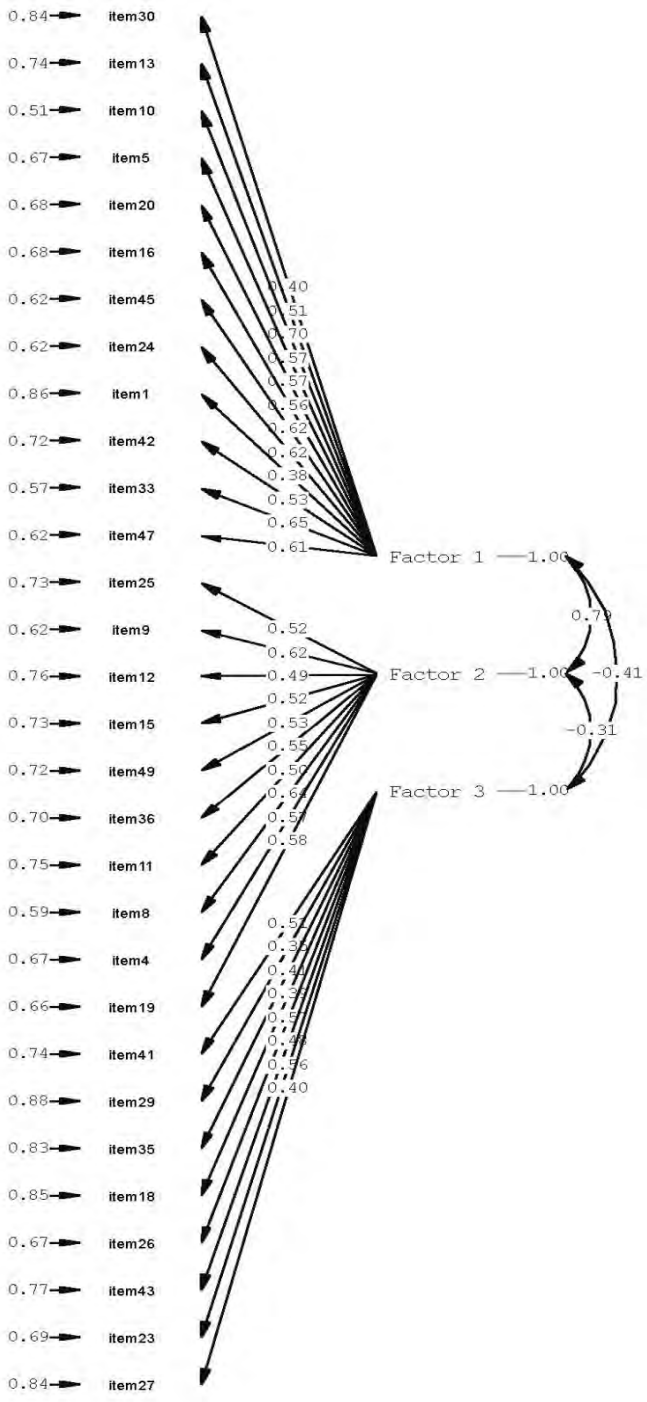

Figure 2. *Path diagram containing the standardized factor loadings for the Role Modeling Perceptions Scale*

The model fit indices can be examined as the t values and factor loads have reached the statistically desired level. The Chi-square ($\chi 2$) value for the priority model is 779.33, with degrees of freedom (df) equal to 402, a p-value of 0.00, and a ratio of $\chi 2$ to df of 1.94. The Chi-square value is low yet significant regarding model fit indices; the $\chi 2$ / df ratio is below 3, indicating an optimal fit (Secer, 2017, p. 190). While the initial outcomes for the model fit appear favorable, the significance of the $\chi 2$ value necessitates a review of additional fit indices to enhance the statistical validation of the model (Table 4).

Table 4. *CFA Fit Indices and Results for the Role Modeling Perceptions Scale*

Fit Indexes	Acceptable limit	Perfect fit limit	Value of scale	The scale's fit decision
NFI	.90 and above	.95 and above	.90	Acceptable
NNFI	.90 and above	.95 and above	.95	Excellent
IFI	.90 and above	.95 and above	.95	Excellent
RFI	.90 and above	.95 and above	.89	Acceptable
CFI	.95 and above	.97 and above	.95	Acceptable
GFI	.85 and above	.90 and above	.86	Acceptable
AGFI	.85 and above	.90 and above	.83	Acceptable
SRMR	Between =.050 and =.080	Between = .000 and <.050	.07	Acceptable
RMSEA	Between =.050 and =.080	Between = .000 and <.050	.06	Acceptable

Within the scope of the development of the Role Modeling Perceptions Scale and as a result of the EFA, the scale has been determined to consist of 30 questions and three factors. This scale's structure was confirmed using confirmatory factor analysis.

3. 2. Reliability Analysis Findings

Reliability indicates how consistently a method measures something. On a highly reliable scale, the same results are consistently achieved using the same methods under the same conditions (Fraenkel et al., 2012). In this context, the reliability coefficients for the 49-item draft scale and each item were examined, and then the validity studies were begun. This reliability analysis is explained in detail in the content validity section. As a result of the reliability analyses performed after completing the additional validity studies, the Role Modeling Perceptions Scale was obtained which explains 41.96% of the variance (Table 2) and has a reliability coefficient of .911. The scale consists of 30 questions and has three factors. The factors were renamed by considering the content of the items under the factors with the factors supported by the literature that had been initially predicted theoretically. Table 5 provides the names of the factors in the Role Modeling Perceptions Scale and the results of the reliability analyses of the factors and sample items.

Table 5. *Reliability of the factors and sample items from the Role Modeling Perceptions Scale*

Factors	Items	Reliability Coefficient	CR	AVE	Sample Item
Reproduction	30, 13, 10, 5, 20, 16, 45, 24, 1, 42, 33,47	.876	.86	.34	I like that my siblings make frequent arrangements in their daily lives when their plans are disrupted.
Retention	25, 9, 12, 15, 49, 36, 11, 8, 4, 19	.838	.83	.33	I appreciate my science teacher jotting down important things about me so I can find a solution to a problem.
Motivation	41, 29, 35, 18, 26, 43, 23, 27	.752	.79	.33	I find it unnecessary for my friends to make an effort about a concept that they cannot learn in science class.
Total		.91	.94	.33	

Table 5 shows Cronbach's alpha of reliability and composite reliability for each sub-dimension to be greater than 0.70 (Pallant, 2020), with the AVE value of around 0.5 being evidence of composite reliability (Hair et al., 2011). When the sample items given for the dimensions in Table 5 are examined and compared with Table 1, it is seen that there are items that are not included in the same dimension. The sample item given under the retention dimension in Table 5 was tried to be written as an expression suitable for the motivation dimension while preparing the draft scale. However, as a result of the validity and reliability analyses, it was found that this item was in the retention dimension. Upon concluding the validity and reliability studies, the primary author utilized the Sekonic Program to create the visual format of the scale to enhance its usability. Utilizing a visual format for data collecting will reduce error rates during the transfer of raw research data to the computer.

4. Discussion

This study evaluated the psychometric properties of the scale to determine the role modeling perceptions of secondary school students and was based on the social cognitive theory of the scale. The literature shows many studies to have evaluated the concept of role modeling within the framework of social cognitive theory (Ata, 2018; Atkin, 1976; Bandura, 1971; Barretti, 2007; Bayrakci, 2007; Hibberd, 1983; Khan & Cangemi, 1979; Reinhardt et al., 2018; Sanderse, 2013). Therefore, the developed scale can be said to be based on solid theoretical foundations.

Similar to the scale development studies in literature, a literature review was conducted to ensure content validity, and no scale was found to measure perceptions toward role modeling in the field of science education. For this reason, the items from the Role Modeling Perceptions Scale were created with a science educator who is also an assessment and evaluation specialist. While creating the scale items, the four processes (i.e., attention, retention, reproduction, and motivation) specific to effective modeling as predicted by social cognitive theory were taken into consideration. In addition, close and distant social environment elements (parents, science teachers, siblings, friends/peers, and celebrities) that a secondary school student might choose as role models were selected. The authors created the scale items according to these two basic criteria. A pilot study was executed to evaluate the appropriateness of the items. Prior to conducting the validity analysis, the reliability coefficients for each of the 49 items were assessed.

EFA and CFA were performed to ensure construct validity. As a result of the EFA, a structure consisting of 30 questions and three factors explaining 41.96% of the total variance was obtained. Considering that the factors in the scales developed in the field of social sciences must meet at least 40% of the total variance, the scale demonstrates validity to be valid at an acceptable level (Buyukozturk, 2008). When examining the factors of retention, reproduction, and motivation that were obtained as a result of the EFA, the items are seen to have solid theoretical foundations that preserve the support of Bandura's (1986) social cognitive theory. We observed that the items belonging to the attention dimension in the draft scale were distributed among other dimensions. The results from the CFA confirmed the 30 items and three factors structure. When examining the scale development studies carried out in the field of science education, a separate sample is seen to be used for CFA in studies conducted in recent years (Kadioglu Akbulut et al., 2020; Kirbulut et al., 2016; Oz & Sen, 2018). The current study verified the factor structure in the CFA using a sample that had never encountered the questions in the scale. In this respect, the construct validity of the developed scale can be said to have been ensured. Within the scope of reliability studies, after performing the validity analysis, we calculated Cronbach's alpha of reliability and composite reliability for the final version of the scale and each factor. The reliability coefficient was .91 for the overall scale, .88 for the factor of reproduction, .84 for the factor of retention, and .752 for the factor of motivation. The developed scale and each of its factors were concluded to have high reliability (Fraenkel & Wallen, 1996). The present study has also reported the reliability coefficients for each factor. Thus, the authors aimed to know and assess whether the results are reliable not only for the whole scale but also for each factor. The composite reliability of the overall scale was 0.94 and the reliability coefficients of the factors were 0.86 for reproduction, 0.83 for retention, and 0.79 for motivation. In addition to Cronbach's alpha reliability, we also calculated composite reliability coefficients. Calculating and comparing the reliability values of a measurement tool using two different analyses provides strong evidence for the reliability of the scale. The AVE values of the scale we developed did not fully meet the desired value.

Therefore, the convergent validity of the scale needs to be strengthened (Hair et al., 2014). On the other hand, the fact that the composite reliability coefficients in our scale are greater than the AVE values are strong evidence for construct validity (Byrne, 2016).

In contrast to what is found in the literature, the scale was used to create a visual form. Gains like error-free data transport and simplified application are being pursued so that researchers can devote their time and effort to more fruitful endeavors. Consequently, we offer the psychometric data of a new assessment instrument for use in science education that is grounded on social cognitive theory and designed to be easily comprehensible to students in secondary school.

5. Conclusion

As a result of the validity checks, we determined that 30 items and a three-factor structure explained 41.96% of the variance. As a result of the reliability checks, we calculated Cronbach's alpha reliability as .91 and composite reliability as .94. As a result, we developed a valid and reliable measurement tool that program implementers and researchers can measure students' perceptions of role modeling.

The scale created for this study was designed for middle school pupils. To facilitate student responses to teacher-related items, science education was limited. Given these constraints, the proposed scale can be utilized by science educators at all educational and training stages to assess students' perceptions of role modeling. In addition, teachers can determine their students' developmental levels in terms of role modeling perceptions and create a portfolio file by applying the scale at the end of a semester or school year. The scale can be used at the beginning and end of did you mean implementation? to determine whether any strategy or method used in science education has affected students' perceptions of role modeling. This developed scale can be used as a data collection tool in quantitative research.

5. 1. Implications for practice

Scope of study;

- If students respond positively to items that assess their attention to a teacher's organizational behavior (e.g., "It draws my attention that my science teacher checks the course instructions again after the unit is over"), this signals to teachers that their behaviors directly influence how students approach and manage their learning, allowing teachers to adjust teaching strategies to influence these perceptions and support learning through modeling positively.
- The scale could be used as an instrument for measuring the impact of teaching methods based on social-cognitive learning in educational interventions.
- The scale provides the teachers with an instrument to understand and enhance their modeling of students' academic and motivational behavior (Schunk, 2012).
- The scale provides teachers with important data on how to adapt the educational intervention and how to promote the effective learning through teachers' or peers' modeling as role models, both from teachers and peers, play an important role in students' academic performance (Hattie, 2009).

5. 2. Highlights

Scope of study;

- A valid and reliable scale that can be used to determine the perception of role modeling was developed.
- Scale development process steps were followed and reported respectively. It provides guidance for future scale development studies.
- Scale development studies in the literature generally conduct only a single analysis for reliability checks. In this study, a composite reliability coefficient was also calculated to confirm the cronbach alpha reliability coefficient.

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