African Educational Research Journal
Vol. 11(1), pp. 1-20, January 2023
DOI: 10.30918/AERJ.111.22.061
ISSN: 2354-2160
Full Length Research Paper

Scale development and validation study on the using YouTube as a learning environment in secondary education according to the technology acceptance model

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Accepted 4 November, 2022

ABSTRACT

In today's technologies, in line with the needs of the age, social platforms have taken their place in education with increasing importance day by day. Especially in the pandemic process, which requires distance education, the tendency to social media has increased. Therefore, the attitudes of secondary school students towards the use of YouTube for learning purposes have gained importance. For this reason, it is aimed to develop the YouTube Usage Scale (YUS), which can be used to determine secondary school students' attitudes toward YouTube use. Thus, in the study, it was foreseen to determine the behavioral intentions of secondary school students to use YouTube as a Learning Resource and to reveal the factors affecting this behavioral intention. The research population consists of all secondary school students studying in the Malazgirt district of Muş province, located in the eastern part of Turkey, in the 2018-2019 academic year. The sample of the study is represented by 644 students selected by the random sampling method. The content validity of the YUS was provided by expert opinion. The construct validity was validated by exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). For content validity, a 47-item draft YUS was submitted to the opinion of a group of 14 experts in the field. The content validity of the 42-item YUS was ensured. In the construct validity studies of YUS, EFA was performed with a total of 644 secondary school students studying in the 5th, 6th, 7th and 8th grades. CFA was carried out with the participation of 311 secondary school students excluding the EFA sample group. EFA showed that YUS consisted of 4 sub-dimensions and 25 items. The Cronbach's alpha coefficient was found to be 0.91 in the reliability analysis of YUS. Also, in reliability studies, it was determined that the subscales had summability and no response bias. The fit-order between the four-factor structure determined as a result of EFA and the sample data was examined using the AMOS 24.0 program within the framework of the Technology Acceptance Model (TAM). First- and second-order confirmatory analysis models were used in the data-model fit calculations. As a result of the study, the validity and reliability of the 24-items YUS scale were produced. Thus, the structures explaining the behavioral factors of secondary school students were defined, and the relationship of these structures with other factors was determined.

Keywords: Secondary school, YouTube, scale development, technology acceptance model.

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INTRODUCTION

The world is changing and developing day by day, just like a living creature. Due to the nature of change, many areas of life have been affected and renewed and different phenomena have arisen. Adapting to the developments in the world has become an indispensable part of life for individuals. The fact that technology and the internet are indexed to daily life has made them the most important element of these changes. These changes have led to new horizons in education, as in many areas, and have affected not only the lifestyle but also the way of learning (Dominici and Palumbo, 2013). The growing popularity of the Internet and rapid updates in web-based technologies have expanded the pedagogies of teaching and learning (Cheng and Chau, 2016). In this framework, electronic learning (e-learning) environments that minimize temporal and spatial problems have taken a place in our lives. The concept of e-learning, which has various sub-titles according to the elements based on the learning need, can be expressed as the learning situation provided by the mediation of any electronic device in general. In addition to face-to-face learning, e-learning is used in various educational environments such as academia and industry (Cheng and Chau, 2016) and is accepted by the education sector and industry due to its many advantages (Panigrahi et al., 2018). Thanks to these platforms that have emerged with the idea of learning anytime, anywhere, e-learning is turning into a concept that enters the life of users. However, it is necessary to examine the effects underlying the use of this concept adopted by individuals and determine the advantages and disadvantages in this direction. For this reason, every academic study related to the e-learning environment is of critical importance to understanding the relationship between individuals and technology.

For this reason, Burke and Snyder (2008) mentioned the use of the YouTube application as an innovative educational technology in the events held on courses related to the health sector. In addition, it has been emphasized that it has a role in enriching the course contents in higher education institutions. Clifton and Mann (2011) recommended the use of YouTube in learning processes because it increases student participation and allows students to access information independently of time and place. Also, Dreon et al. (2011) suggested the use of applications such as YouTube as a powerful educational material to increase the permanence of what teachers tell students. Therefore, it can be said that such materials can be used in classroom activities and have positive effects on students when integrated into lessons in learning processes (Tan and Pearce, 2012). Again, Logan (2012) reported that the use of the YouTube social network for educational purposes positively affects student participation. Also, students can easily establish the link between theory and practical applications. Accordingly, it has been suggested that the relevant materials in the YouTube social network should be extracted and used as educational material in the teaching process (Duncan et al., 2013). Accordingly, by using YouTube materials as a teaching activity in many different fields of science, students' interest can be attracted, their academic success can be increased, and the desired permanent behavior changes can be achieved in students (Duisembekova, 2014). According to the research, the higher education institutions that use YouTube video educational materials most in the teaching process are the Massachusetts Institute of Technology and Stanford University (Ata and Atik, 2016). The effects of YouTube educational materials on the teaching process have been researched in a wide variety of fields such as medicine (Barry et al, 2016, Bae and Baxter, 2017), the military (Küçükyılmaz, 2016) marketing sector (Orus et al., 2016; Çiçek, 2018) and internet use (Alp and Kaleci, 2018). In almost all of these studies, it has been determined that YouTube educational materials increase the interest and motivation of the participant and provide permanent learning. Finally, Academic learning factors are affected because of being addressed in multiple senses by YouTube. On the other hand, some studies have focused on examining the reasons for the intensive use of YouTube educational materials in the teaching process within the framework of TAM. Lee and Lehto (2013) analyzed the behavioral intentions of YouTube users on videos using the TAM. Accordingly, they reported that the behavioral intention variable in the TAM was significantly affected by user satisfaction and perceived benefit variables. Chintalapati and Daruri (2017) examined the reasons and intentions of individuals to use the YouTube platform within TAM. As a result of the research, a framework was created for perceived ease of use and perceived usefulness. From all these results, it was seen that some of the studies investigated the content of the YouTube platform, while others examined the YouTube platform as additional material that can help formal education. In this respect, it can be easily assumed that the YouTube social network is an important material for reaching different age groups, different cultures, different disciplines, etc. for different purposes. However, although there are studies for various peer groups in the literature, there are not many studies specific to secondary school students. In addition, to our knowledge, although it has been up-to-date in recent years, no measurement tool examines the acceptance and use of the YouTube platform by secondary school students.

Problem status

One of the reasons why social platforms affect our lives with the development of technology is the Covid-19 epidemic that started in Wuhan, China in December 2019, and it still shows its effect. With the announcement of the epidemic in the world, many institutions focused on digital environments for the continuity of their applications. Especially the interruption of face-to-face education in education showed how unprepared it was for this situation and revealed the deficiencies in the digital environment. In this process, various systemic problems occurred in distance education. For this reason, individuals have started to show interest in alternative applications. Among the platforms that individuals tend to, the most used ones have been video-supported social media. One of the most popular among them is the YouTube application. Therefore, YouTube, which will maintain its place in our lives in the future, will be much more important for individuals. In this respect, no model explains the level of use of YouTube videos as educational material and the behavioral intentions of students studying in secondary education. Therefore, the factors affecting the use of YouTube for learning purposes are not known. According to the explanations, the problem sentence of the research is created as "What are the variables that affect the secondary school students' use of YouTube for learning?" On the other hand, sub-problems

- Has the content validity of the scale developed for secondary school students' YouTube usage been ensured?
- Has the construct validity of the scale developed for secondary school students' YouTube usage been ensured?

Importance and purpose of the research

The importance of technology is increasing day by day in the developing and changing world in today's conditions. Increasing technological developments limit the role of the human factor in communication. For this reason, individuals have begun to minimize human interaction. Since social platforms began to spread to every part of our lives, they have developed in many areas from the service sector to education. Social platforms, which continue to be updated with renewed interfaces in line with new needs, started to host information in many fields such as health, public, and education. With the development of the internet, social media has now become more accessible. This result has made social platforms the first choice for people. Over time, false and/or incomplete information has spread to a wide audience with the trust built up against social platforms. Considering the pandemic process, individuals have met some of their education deficiencies from social platforms (Al Lily et al., 2020). In this process, one of the most preferred social-sharing platforms has been YouTube, since it is a free video-sharing site that allows users to create and publish content (Ryu et al., 2009). In procedural learning in this process, YouTube was also used by students for educational purposes as it appeals to more senses than written materials (Rössler et al., 2012). However, individuals did not pay attention to how they perceived the potential of new learning environments. Therefore, Muthitacharoen et al. (2006) highlighted the importance of examining how individuals agree to use a single system to perform external tasks, given the versatile and flexible nature of information technology. For this reason, the user acceptance process of YouTube in this study has been examined using the TAM. TAM is based on the extrinsic motivations of individuals (Muthitacharoen et al., 2006). The scope of work is aimed to develop and validate a conceptual framework for the acceptance of YouTube by secondary school students in procedural learning. In addition, it was aimed to investigate what factors affect secondary school students' intention to use the YouTube platform and how these factors affect each other, that is, what kind of relationship there is between them. Thus, the study was conducted by considering the perceived usefulness (PU), user attitude (UA), behavioral intention (BI), and perceived ease of use (PEU) sub-dimensions in the TAM. In this respect, it is predicted that the measurement tool obtained will be an important tool in measuring secondary school students' attitudes toward YouTube use and determining their extrinsic motivation.

Selection of TAM

In the literature, some models are proposed to examine the adoption of information technology. These models are the Theory of Reasoned Action, Theory of Planned Behavior (Mathieson, 1991), Technology Acceptance Model (Davis and Venkatesh, 1996, Davis, 1989), and Unified Theory of Acceptance and Use of Technology (UTAUT) (Guo and Liu, 2013). They are based on the Theory of Reasoned Action (TRA). TRA proposes that an individual's actions can be predicted based on their pre-existing attitudes and behavioral intentions. However, the TAM examines the acceptance of information technology based on the TRA model (Davis, 1989). Therefore, it is a model that better explains the behavior of individuals against the acceptance of information technology (Moon and Kim, 2001). For this reason, the TAM model was used in the study.

METHOD

This study was designed using the sequential exploratory mixed method. This method offers researchers many different advantages in measuring tool development studies and is very effective. Here, the qualitative data is transformed into quantitative data (Creswell, 2014). This method can also be used to develop a measurement tool to understand a phenomenon (McMillan and Schumacher, 2006). In this context, firstly, focus group interviews were conducted with a group of secondary school students to create an item pool. Expressions that could be an attitude item about the use of YouTube were selected from the interviews. Some items were also created from the literature through the panel system. Then, the created items were submitted to expert opinion for content validity. In measurement tool development studies, content validity rates are applied when experimental applications are not possible. The content validity ratio is a method used to transform qualitative studies based on expert opinions into statistical quantitative studies.

Research prospectus outlined

This research aimed to develop a valid and reliable instrument that would serve to measure secondary school students' attitudes toward YouTube usage. The data of the study were collected from a total of 644 students (Grades 5 to 8) studying at three different public secondary schools in a city located in the north of Turkey. The details of the research prospectus and the steps which were followed to develop the instrument were presented under sub-headings in Table 1.

Table 1. The steps which were followed in the study.

Subproblem	Pathway	Stage	Process
Subproblem 1	Content Validity	Stage 1	The items were collected from the literature of TAM and the data was also obtained as a result of the focus group interviews. The draft form was created with 47 items. The content validity of the form was provided by "expert opinions".
		Stage 2	CVR-CVI values of each item in the draft form were calculated. Items "6-15-39-43-45" were removed from the draft form. Face validation was performed with a group of secondary school students
Subproblem 2	Construct validity	Stage 3	The construct validity of the draft form was provided by EFA. EFA was performed on the data from 644 secondary school students. Items "4-5-6-7-8-11-13-14-16-19-20-32-33-36-37-39-41", which could not meet the construct validity assumptions, were removed from the draft form.
	Control of test items	Stage 4	Anova Tukey's Nonadditivity analysis was carried out on the homogeneity and their relationship with each other of the items in the draft form. Whether the phenomenon can be measured appropriately with the measurement tool was determined by Hotelling's T-Squared analysis. Sequence validity of the items in the measurement tool was performed by Intraclass correlation coefficient
	Confirmation of Construct validity	Stage 5	The confirmation validity of the draft form was performed on the data from 311 secondary school students. These data were obtained from a different sample from the sample group used in the pilot application. Item "25", which could not meet the construct validity assumptions, was removed from the draft form.
	Reliability	Stage 7	Cronbach's alpha coefficients were computed for each sub-factor and overall the measurement tool
	Modeling	Stage 8	The data-model fit was tested
	Result	Stage 9	A valid and reliable measurement tool, namely YUS was prepared. YUS contained 24 productive Likert-type items

Data collection process for EFA

This study includes secondary school students' attitudes toward the use of YouTube as a learning environment. In this context, firstly, the existence of measurement tools with validity and reliability under the purpose of the study was investigated in the literature, but to our knowledge, a suitable measurement tool could not be determined. For this reason, the YouTube Usage Scale (YUS) was developed and used to measure the attitudes of secondary school students toward the use of YouTube as a learning environment. Accordingly, a group of secondary school students was asked to write an essay describing their feelings, thoughts, and skills regarding the use of YouTube. 10 respondents have helped in this qualitative research. Some expressions were included in the draft YUS by reading the compositions. In addition, by using the relevant databases in the literature related to TAM, the criteria items regarding the YouTube use of secondary school students were searched. The panel system was used in the translations (Beaton et al., 2007). Attention was paid to reflect the cognitive, affective, and behavioral dimensions of the criterion items thought to be included in the measurement tool. Items were designed according to the operational variables of the TAM. These variables are perceived usefulness (PU), perceived ease of use (PEU), user attitude (UA), and behavioral intention (BI). Later, an item pool consisting of 47 Likert-type attitude items (1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: strongly agree) was created. Then, the draft YUS was presented to a group of 14 field experts. Each item in the draft YUS was evaluated by the expert group in terms of language, scope, and psychometrics. After the content validity of YUS is ensured, a pilot application was carried out for EFA by adding a personal information form containing various categorical variables and a menu about the "not related to me" option.

Demographic profile of the respondents for EFA

The definition of the universe in scientific studies refers to a large set of generalizations about the findings of the study. Every element with common characteristics can be evaluated in the universe. Researchers can classify groups according to certain criteria and create universes of different sizes (Gürbüz and Şahin, 2018). The universe of this research consists of 4635 secondary school students studying in the Malazgirt district of Muş province, located in the north of Turkey, in the 2018-2019 academic year. The sample of the study consists of 644 students selected by the random sampling method. Determining the sample size from the universe was determined by the formula given below based on the population size (Yamane, 1967).

$$n = \frac{(Nt^2pq)}{(d^2\,(N-1)+t^2pq)} \quad (1)$$

In Equation 1, N: Number of individuals in the target population (main mass), n: Number of individuals to be sampled, p: Probability of occurrence of the investigated event (0.10), q: the probability of not happening of the investigated event (0.90), d: ± the sampling error accepted according to the incidence of the event. (0.05), t: the theoretical value (1.96) found according to the t table at a certain significance level. Here the number of students to be sampled from Equation (1) was found to be 548 at the 99% confidence interval. However, 644 secondary school students were included in the study. Accordingly, 295 (45.8%) of the 644 students were girls, and the remaining 349 (54.2) students were boys. In addition, 190 (29.5%) of the research participants were in the 5th grade, 135 (21.0%) were in the 6th grade, 175 (27.2%) were in the 7th grade, and 144 (22.4%) were in the 8th grade. Of the families of the participants, 54 (8.4%) were in the village, 547 (84.9%) were in the district, 32 (5.0%) were metropolitan, 8 (1.2%) were metropolitan, 3 (0.5) reside abroad. In addition, according to YouTube usage time, the number of students using 1-2 hours a day is 485 (72.2%), the number of students using 3-5 hours a day is 139 (21.6%), the number of students using 6 hours or more a day is 31 (4.8%), the number of students who use less than 1-2 hours a day is 9 (1.4%). According to the social media usage variable, the number of students using YouTube is 486 (75.5%), the number of students using Facebook is 54 (8.4%), and the number of students using other social media tools is 104 (16.1%). However, the number of students who subscribe to the YouTube application is 275 (42.7%).

Data collection process for CFA

Data were collected from 311 participants using the face-to-face method. Since the purpose of data collection is scale validation the questions on categorical data were not reduced in Study 2. Attention was paid to the fact that the respondents in the 1st study and the 2nd study were different. For this purpose, two different schools were preferred, apart from the schools where the data were collected in Study 1. The respondent inclusion criterion and the scale items were the same as those used for study 1. The option 'not relevant to me' was not provided in study 2. This situation was preferred to ensure that there are no missing data in the data to be used in CFA and not to cause measurement bias (Gliem and Gliem, 2003). Data was used to confirm the hypotheses and CFA (Yong and Pearce, 2013). Since the research is about secondary school students, it is thought that the sample is suitable for measurement tool development.

Demographic profile of the respondents for CFA

311 secondary school students were included in the CFA study. Accordingly, 127 (40.8%) of the 311 secondary school students were girls, and the remaining 184 (59.2) were boys. In addition, 129 (41.5%) of the research participants were in the 5th grade, 41 (13.2%) were in the 6th grade, 69 (22.2%) were in the 7th grade, and 72 (23.2%) were in the 8th grade. The living places of the participants are village (28, (9%)), district (263, (84.6%)) and city (20, (6.4%)). In addition, according to YouTube usage time, the number of students using 1-2 hours a day is 222 (71.4%), the number of students using 3-5 hours a day is 67 (21.5%), the number of students using 6 hours or more a day is 20 (6.4%), and the number of students who use less than 1-2 hours a day is 2 (0.6%). According to the social media usage variable, the number of students using YouTube is 238 (76.5%), the number of students using Facebook is 30 (9.64%), and the number of students using other social media tools is 43 (13.86%). However, the number of students who subscribe to the YouTube application is 132 (42.4%).

RESULTS AND DISCUSSION

Overview of statistical analyses

The statistical analyses were performed in four steps. The content validity of the draft form created in the first step was ensured by the expert opinion of 14 people. In the second step, EFA was carried out to explore the underlying factor structure of the measurement tool. EFA was performed using SPSS 21.0 with the maximum likelihood method (MLM). Here, the interactions between items were examined. The structure of the factors obtained from EFA in the third step was confirmed by CFA (Yong and Perce, 2013). CFA was conducted using Analysis of Moment Structure (AMOS) 21 with MLM. In addition, the convergent and discriminant validity between variables and Cronbach's alpha coefficient recommended for the Likert-type measurement tool was calculated for each subscale and the whole measurement tool (Reynolds et al., 2006). In the last step of the study, hypotheses belonging to the variables of the TAM were established and their validity was examined.

Findings related to subproblem “Has the content validity of the scale developed for secondary school students' YouTube usage been ensured?”

Scope validity

Content validity is a concept that expresses the extent to which all separately developed items reflect the attitude expected to be measured. The content validity of a measurement tool depends on the attitude that all the questions in the test want to measure and how well they meet the content of the examined theme. In this direction, the content validity of YUS was carried out according to the guidelines prepared by Polit and Beck (2006). These are *i*-preparing the content verification form, *ii*-selecting a review panel consisting of expert staff, *iii*- verifying the content, *iv*-examining the domains and items, *v*-providing the score for each item, *vi*- calculating the scores of CVR, I-CVI, and S-CVI. Accordingly, the item pool was first created from a group of students through a focus group interview and a review of the TAM. literature. The panel system was used in translations. Then, field experts were chosen to ensure the content validity of the draft form (Tavşancıl, 2006). A space is left under each item for experts to add explanations if they seem necessary. The first draft of the measurement tool was presented to the people whose numbers and areas of expertise are given below:

- two instructors working in the Department of Turkish Education at the Faculty of Education to control the written language.
- For item analysis, a total of four lecturers who are field experts in the Department of Mathematics and Science Education and one assessment and evaluation specialist
- six science teachers and one Turkish teacher working in institutions affiliated with the Ministry of National Education.

Accordingly, field experts were asked to express their opinions on each item separately about the simplicity of the test language, how the test is organized, whether the items required expertise, the adequacy of the number of items, and the inadequacy of the items. In this arrangement, each item was scored as follows:

- The item has nothing to do with the measured area, it should be removed (1 point)
- The item is somewhat related to the measured area, it should be rearranged (2 points),
- The item is related to the measured area, but it requires little adjustment (3 points),
- The item is very relevant to the measured area, the item should remain in the form (4 points) (Yusoff, 2019).

High validity in a measurement tool increases the accuracy of the phenomenon that is aimed to be measured. While ensuring the validity of the content, the items decided to be included in the measurement tool are examined and revised in line with the opinions of the expert group. Then it is ensured that the errors are cleared. Finally, the scoring of items was performed and validity indexes such as content validity index, (CVI) and content validity ratio (CVR) were calculated in scoring. CVR determines the importance of each item in the test. CVI is used to determine the relationship of each item to the measurement tool. Here CVR is calculated by Equation 2, given the following (Ayre and Scally, 2014):

$$CVR = \frac{A}{N/2} - 1 \qquad (2)$$

Where N and A show the total number of experts and indicate the number of experts who gave a “relevant” rating (3 or 4 points). Accordingly, the number of experts who gave “relevant” feedback in the calculation was included in the measurement. On the other hand, to the experts who stated the option, “it should be corrected (2 points)”, “What is your suggestion?” open-ended questions were asked. To experts who answered “It should be removed (1 point)” “Why?” question was asked and relevant notes were taken. CVI was determined by calculations in reports of Lynn (1986) and Polit and Beck (2006). In the interpretation of CVR, the content validity criterion ($CVR_{critical}$ = critical CVR) was separately used for each item that reached a positive value at the $\alpha = 0.05$ significance level. As a result of the evaluation of 14 experts, the critical CVR recommended by Ayre and Scally (2014) is 0.51. Accordingly, it was determined that the CVR of items 6, 15, 39, 43 and 45 in the draft form were lower than the critical value in line with the opinion of 14 field experts at the $\alpha = 0.05$ significance level. The CVR was first suggested by Lawshe (1975). It was then modified by Ayre and Scally (2014). However, both have based the CVR on the empirical appropriate. Therefore here, the calculations of content validity were expanded by considering Yusoff (2019)'s suggestion. Yusoff (2019) suggested 2 separate CVI forms. These are the item-level content validity index (I-CVI), which defines the scope index of the item, and the scale-level content validity index (S-CVI), which examine the overall content validity of the measurement tool. From here, I-CVR was found to investigate whether each item in the measurement tool will be used as a criterion. In addition, S-CVI was calculated to determine whether the experts were compatible with each other. In addition, S-CVI can be expressed in two different ways. The first is the S-CVI/Ave, which is obtained from the average of I-CVI of all the items. The second is the S-CVI/UA value obtained from the average of the number of experts who marked as 3 or 4 the relevance of all items in the measurement tool. S-CVI/UA is also expressed as a universal consensus method. The concepts mentioned here have been previously reported by Lynn (1986) and Polit and Beck (2006). Accordingly, it was stated that the I-CVI should be a minimum of 0.78 or higher, in studies consisting of 5 or more experts Polit and Beck (2006). According to this, the I-CVI values of items 6, 15, 39, 43 and 45 in the YUS were obtained as less than 0.78. S-CVI/Ave and S-CVI/AU values should also be at least 0.8 for the general validity of a measurement tool (Orts-Cortés et al., 2013). If the value reached is above 0.90, the scope validity of the measurement tool is considered “excellent”. S-CVI/Ave and CVI/AU for the draft YUS were found to be 0.93 and 0.84, respectively. After these calculations, the scores obtained from the expert opinion were converted to the kappa index to take into account the chance factor that may occur among the participants in estimating the I-CVI. The Kappa index (k*) is an inter-expert fit index that shows that the item is relevant, clear, and understandable, beyond the possibility of being an interesting feature (Wynd et al., 2003). However, k* was found according to the kappa sequence suggested by Fleiss (1971). The Fleiss’ kappa scale classifies as “item is perfect If k* is greater than 0.74”, “item is good If k* is between 0.60-0.73” and “item is poor If k* is less than 0.39” each item in a measurement tool. k* can be calculated from Equations 3 and 4:

$$pc = \left[\frac{N!}{A!(N-A)!}\right] 0.5^N \quad (3)$$

$$k = \frac{I-CVI-pc}{1-pc} \quad (4)$$

In equations k, pc, N and A are kappa coefficient, probability of random correlation coefficient, namely chance fit ratio, number of experts, and the number of experts who gave a rating of “relevant” with 3 or 4 points, respectively. Microsoft Excel 2019 software program was used for all calculations. The calculations exhibited that the Fleiss kappa coefficients of items 6, 15, 39, 43 and 45 were lower than 0.39. According to all these results, 5 items from the 47-item draft measurement tool could not provide sufficient CRV, I-CVI, and kappa values and so 5 items were removed from the draft YUS. As a result, a 5-point Likert-type YUS form containing 42 items was prepared for construct validity. Table 2 shows the expert system for the content validity of YUS.

Face validity

After the content validity, face validity was carried out to examine the language simplicity and structural clarity of the form (Yusoff, 2019). The 42-item draft form, whose content validity was provided, was presented to a panel group of 30 secondary school students using the google form to test the clarity of the items (Hadie et al., 2017; Ozair et al., 2017; Yusoff, 2019). They were asked to evaluate the patency of each test item according to the recommendations. The suggestions in the form are given as “the item is not clear (1 point)”, “the item is somewhat clear (2 points)”, “the item is clear enough (3 points)” and “the item is very clear (4 points)”. The information was requested about whether each item required modification. After then I-FVI, S-FVI/A, and S-FVI/UA indexes were calculated. If all voters have agreed on an item, the Universal agreement (UA) score is 1. The minimum acceptable values of I-FVI and S-FVI values are 0.8 and 0.83. All calculations and determinations of face validity were performed in line with the recommendations of Ozair et al. (2017). From here, I-FVI, S-FVI, S-FVI/Ave, and S-FVI/Ave values were obtained as 0.91, 0.91, 0.93, and 0.83, respectively. A comparative table is not given here since there is no item eliminated in face validity.

Findings related to subproblem “Has the construct validity of the scale developed for secondary school students' YouTube usage been ensured?”

Measurement validity

Firstly, normality analyzes were performed to verify the structural validity of the 42-item draft YUS. In this study, the conformity of the data to the normal distribution was decided by using the kurtosis and skewness coefficients from analytical methods. In the normality test, skewness and kurtosis values should be in the range of -2 to +2 (George and Mallery, 2010). When this condition is fulfilled, the data are regarded as having a normal distribution. The pilot study for EFA was carried out with 644 secondary school students over 42 items. The skewness and kurtosis coefficient was calculated as 0.421 ± 0.098 and -0.019 ± 0.192. Since the data were in the range of -2 to +2, it was determined that the data showed normal distribution.

Factor load analysis

In the study, the compatibility of the scale items to the factor analysis was checked with the Kaiser-Meyer-Olkin (KMO) sample adequacy test and the Bartlett Sphericity

Table 2. Expert system for content validity of YUS.

Items	Expert														Score				N_A	I-CVI	UA	CVR	pc × 10^{-3}	k*	Rating
	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	4	3	2	1							
Item1	4	4	4	4	3	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item2	4	4	4	4	4	4	4	4	4	4	3	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item3	4	4	4	4	4	4	3	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item5	4	4	4	4	4	4	4	4	3	4	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item6	3	2	4	2	2	3	4	3	4	3	2	2	2	2	3	4	7		7	0.50	0	0.00	209	0.37	Poor
Item7	4	4	4	3	4	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item8	4	4	4	4	4	4	3	2	4	4	4	4	4	4	12	1	1		13	0.93	0	0.86	0.85	0.93	Excellent
Item9	4	3	4	4	4	4	4	4	3	4	4	4	4	4	12	2			14	1.00	1	1.00	0.061	1.00	Excellent
Item10	4	4	4	4	4	4	4	3	4	4	4	4	2	4	12	1	1		13	0.93	0	0.86	0.85	0.93	Excellent
Item11	2	4	4	4	4	4	4	4	4	3	4	4	4	4	12	1	1		13	0.93	0	0.86	0.85	0.93	Excellent
Item12	4	4	4	4	4	4	4	4	4	4	4	4	4	3	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item13	4	4	4	4	4	4	4	3	4	4	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item14	4	4	4	4	4	3	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item15	2	2	2	3	2	3	4	4	3	2	2	4	2	3	3	4	7		7	0.50	0	0.00	209	0.37	Poor
Item16	3	4	4	4	4	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item17	4	4	4	4	4	4	4	4	4	4	4	4	4	3	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item18	4	4	4	4	3	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item19	4	4	4	4	4	4	4	4	4	3	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item20	4	3	4	4	4	4	4	4	4	4	3	4	4	4	12	2			14	1.00	1	1.00	0.061	1.00	Excellent
Item21	4	4	4	4	4	4	4	3	4	4	4	3	4	4	12	2			14	1.00	1	1.00	0.061	1.00	Excellent
Item22	4	4	3	4	4	3	4	4	2	4	4	4	4	4	11	2	1		13	0.93	0	0.86	0.85	0.93	Excellent
Item23	4	3	4	4	4	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item24	4	4	4	4	4	4	4	4	3	4	4	3	4	4	12	2			14	1.00	1	1.00	0.061	1.00	Excellent
Item25	4	3	4	4	4	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item26	4	4	3	4	4	4	4	4	4	3	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item27	4	4	4	2	4	4	4	4	4	4	4	2	4	3	11	1	2		12	0.86	0	0.71	5.55	0.86	Excellent
Item28	4	4	4	4	3	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item29	4	4	4	4	4	4	3	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	0.061	1.00	Excellent
Item30	4	4	4	4	4	4	4	4	4	4	4	3	3	4	12	2			14	1.00	1	1.00	0.061	1.00	Excellent
Item31	4	4	4	4	4	3	4	4	4	3	4	4	4	4	12	2			14	1.00	1	1.00	0.061	1.00	Excellent
Item32	3	4	4	4	4	4	4	3	4	4	3	4	4	4	11	3			14	1.00	1	1.00	0.061	1.00	Excellent
Item33	4	4	3	4	4	4	4	4	4	4	4	4	4	3	12	2			14	1.00	1	1.00	0.061	1.00	Excellent
Item34	4	3	4	4	4	4	4	4	4	3	4	3	4	4	11	3			14	1.00	1	1.00	0.061	1.00	Excellent

Table 2. Continues.

Item35	4	4	3	4	4	4	4	4	4	4	4	4	4	4	13	1		14	1,00	1	1.00	0.061	1.00	Excellent
Item36	4	4	4	4	3	2	4	4	4	4	4	3	4	4	11	2	1	13	0,93	0	0.86	0.85	0.93	Excellent
Item37	4	4	3	4	4	4	3	4	4	4	4	4	4	4	12	2		14	1.00	1	1.00	0.061	1.00	Excellent
Item38	4	4	4	4	3	4	4	4	4	4	4	4	4	3	12	2		14	1.00	1	1.00	0.061	1.00	Excellent
Item39	2	4	2	2	3	4	4	4	4	2	2	2	4	4	7	1	6	8	0.57	0	0.14	18.2	0.48	Poor
Item40	4	4	4	4	3	4	4	4	4	4	3	4	4	4	12	2		14	1.00	1	1.00	0.061	1.00	Excellent
Item41	4	3	2	4	4	4	4	2	4	2	4	4	4	3	9	2	3	11	0.79	0	0.57	2.22	0.78	Excellent
Item42	4	4	4	4	3	4	4	4	4	4	4	3	4	4	12	2		14	1.00	1	1.00	0.061	1.00	Excellent
Item43	4	2	2	2	4	4	3	4	4	2	2	2	4	4	7	1	6	8	0.57	0	0.14	18.2	0.48	Poor
Item44	4	4	3	4	4	4	4	3	4	4	4	4	4	4	12	2		14	1.00	1	1.00	0.061	1.00	Excellent
Item45	4	2	2	2	4	4	4	2	2	4	4	3	4	2	7	1	6	8	0,57	0	0.14	18.3	0.48	poor
Item46	3	4	4	4	4	4	3	4	4	4	4	4	4	4	12	2		14	1.00	1	1.00	0.061	1.00	Excellent
Item47	3	4	4	3	4	4	4	4	4	4	4	3	4	4	11	3		14	1.00	1	1.00	0.061	1.00	Excellent
Relevance rate	0.94	0.91	0.91	0.89	0.96	0.98	1.0	0.93	0.93	0.91	0.91	0.91	0.98	0.95				S-CVI/UA		0.84				
The average rate of items evaluated as relevant by 14 experts after removing 5 items, S-CVI/Ave*															0.93									

* NA: Number of Agreement; According to Ayre and Scally (2014), there is no item below the CVR=$CVR_{critical}$ value (0.571); I-CVI: Item content validity; Pc: the probability of random compromise; k*: kappa coefficient; Evaluation criteria of k*: poor ≤0.39, weak = 0.40–0.59; good = 0.60–0.73; excellent ≥0.74 according to Fleiss (1971), S-CVI/Ave* (based on proportion relevance): average proportion of "relevant" scores through experts index; S-CVI/Ave (based on I-CVI): average I-CVI scores of all items.

Test. Bartlett's test of sphericity was significant, and the KMO coefficient was determined as 0.92 ($\chi 2$ = 6516,14, df = 300, $p < 0.01$). For the data set to be suitable for factor analysis, the KMO coefficient should be greater than 0.7 (Leech et al., 2005). If the KMO coefficient is above 0.9, the sample adequacy is interpreted as "excellent" (Büyüköztürk, 2009). These results meant that EFA can be applied to the data set. Statistical analyzes were performed with the SPSS-22 program. MLM was used as a factor extraction method in EFA because it is parallel to the Structural equation model (SEM). While Varimax was used to perform the rotation, the Listwise Selection method was preferred to remove the missing data. EFA showed that there were four factors with an eigenvalue greater than 1 and all sub-factors explained 55.33% of the total variance. This value is a value greater than 40%, which is accepted as the minimum value. However, Field (2009) reported that the significance of factor loading depends on the sample size. Field (2009) suggested that the factor load threshold for a sample of 100 and 200 subjects should be 0.512 and 0.364, respectively. However, here the factor load threshold value has been taken as 0.512, taking into account the "standardized regression weights" of the items with AMOS output. From here, the EFA was carried out on the 42-item draft YUS and it was found that the items were clustered under 4 factors. In addition, the scree plot was also used in factoring the items in the YUS. The sharp decline in the scree plot was seen at the fourth point. Table 3 presents the results of the EFA of the 22 items YUS

As can be seen in Table 3, Items with a factor loading of less than 0.512 were excluded from the factor cluster. In addition, items with a difference of less than .1 in factor loads among items clustered under the same subfactor were considered overlapping (Buyukozturk, 2009). According to this, 17 items were removed from the 42-items draft YUS. YUS consisting of 25 items clustered under 4-factor was obtained. The lowest factor load in YUS. is 0.591 and the highest factor load is 0.782. In addition, Pallant (2007) suggested that the communality value indicating the compatibility with other items of an item in the factor should not be less than 0.3. Accordingly, the results showed that the commonality values of

Table 3. Results of EFA of the 22 items YUS.

Code	Items	Factor loading				Com*	Eigen Value
		PU	UA	BI	PEU		
PU1	S22	0.782				0.643	
PU2	S21	0.719				0.575	
PU3	S23	0.716				0.601	
PU4	S40	0.71				0.543	
PU5	S35	0.692				0.570	8.198
PU6	S34	0.683				0.560	
PU7	S24	0.657				0.534	
PU8	S38	0.649				0.528	
PU9	S25	0.591				0.378	
UA1	S2		0.708			0.595	
UA2	S1		0.695			0.612	
UA3	S12		0.694			0.564	2.224
UA4	S9		0.652			0.520	
UA5	S3		0.646			0.546	
UA6	S10		0.639			0.486	
BI1	S30			0.739		0.603	
BI2	S31			0.702		0.595	
BI3	S29			0.66		0.539	1.95
BI4	S28			0.643		0.504	
BI5	S42			0.617		0.492	
PEU1	S27				0.745	0.585	
PEU2	S18				0.69	0.612	
PEU3	S17				0.688	0.636	1.461
PEU4	S15				0.665	0.531	
PEU5	S26				0.626	0.480	

Com*: Communalities; Total variance explained:55.33%.

the items varied between 0.480 and 0.643. Here the factors were named according to TAM, taking into account the expressions of the items. In this context, as a result of EFA, the first factor consists of nine items (S22, S21, S23, S40, S35, S34, S24, S38, S25). The second factor consists of six items (S2, S1, S12, S9, S3, S10). The third factor consists of five items (S30, S31, S29, S28, S42), and the last factor consists of five items (S27, S18, S17, S15, S26). The first factor explained 32.79% of the total variance, the second factor 8.90%, the third factor 7.80%, and the last factor 5.84%.

Reliability analyzes

Reliability is an indicator of how well a test or scale measures what it is intended to measure. A reliable test or scale should yield the same results in similar situations. Accordingly, the reliability of YUS was determined using the 'Split Half' model (to determine the consistency between the feedback) and Cronbach Alpha values. Table 4 shows the results of split-half reliability analyses for YUS.

In Table 4, the alpha values of the first and second parts are close to each other, and these values are greater than 0.70. This result shows that the items are consecutive and reliable (Berkün, 2010). Similarly, the correlation value between the forms, the Guttman Split-Half coefficient, and the Equal and Unequal Length Spearman-Brown coefficient was 0.797, 0.887 and 0.887, respectively. Also, Cronbach alpha values for both halves were calculated as 0.845 for the first half (13 items) and 0.834 for the second half (12 items). In addition, ANOVA (Anova with Tukey's Test for Nonadditivity) was performed to determine whether the items in YUS have similar structures, collectability, and homogeneity. The results are presented in Table 5. Table 5 showed that the items contained a homogeneous structure. On the other hand, it was found that items are related to each other. Also, it was determined that the test was collectible

Table 4. Results of split-half reliability analyses for YUS.

Confidence Coefficients (N:25)	
Correlation Between Forms = 0.797	Equal Length Spearman-Brown = 0.887
Guttman Split-Half Coefficient = 0.887	Unequal Length Spearman-Brown = 0.887
Alpha = .845 (N:13[a]) for Part1	Alpha = .834 (N:12[b]) for Part2
[a]Items: S1, S2, S3, S9, S10, S12, S15, S17, S18, S21, S22, S23, S24;	
[b]Items: S25, S26, S27, S28, S29, S30, S31, S34, S35, S38, S40, S42	

Table 5. The Anova results of YUS.

			[b]KT	df	[c]OK	F	p
Between People			7960.451	643	12.380		
Within People	Between Items		649.543	24	28.241	25.26	.000
	Residual	Nonadditivity	105.601[a]	1	105.60	95.05	.000
		Balance	16428.397	14788	1.111		
		Total	16533.998	14789	1.118		
	Total		17183.542	14812	1.160		
Total			25143.992	15455	1.627		
Grand Mean = 3.06							

[a]Tukey's estimate of power to which observations must be raised to achieve additivity = -0.720.
[b]KT: Sum of Squares, [c]OK: Mean squares.

($F = 95.05$, $p < .001$).

Özdamar (2013) suggested Hotelling's T-Squared analysis to determine whether a phenomenon can be measured with a suitable scale. Accordingly, Hotelling's T-Squared Test was conducted to determine whether the test design was appropriate in terms of the reliability analysis applications of the YUS. According to the results obtained, the YUS presented a suitable structure ($F = 831.49$, $p < .05$). The data regarding Hotelling's T-Squared analysis of YUS are given in Table 6.

In addition, the sequences and structural properties of the items in the YUS were determined by the interclass correlation coefficient (ICC). Accordingly, it was found that the YUS was consistent in terms of individual items (ICC = 0.296, $p < .05$). YUS had a reliable construct validity in terms of mean measures (ICC = 0.910, $p < .05$). Briefly, the items in YUS are valid and reliable in terms of their sequence and structural properties (Özdamar, 2016). As a result of the measurement, ICC showed that YUS was weak for single measurements (0.296) and very good for average measurements (0.910) (Ridout et al., 1999). Results from Hotelling's T-Squared analysis of YUS are given in Table 7.

Cronbach's Alpha value was also checked for the reliability of YUS. Although many techniques are used for reliability, the most popular technique is Cronbach's alpha coefficient (Sharma, 2016). The alpha coefficient is used to estimate the internal consistency of composite scores in describing the reliability of multiitem scales. Table 8 shows Cronbach's Alpha coefficients for the whole scale and its subdimensions.

Table 6. Hotelling's T-Squared Results related to the item structure of the YUS.

Hotelling's T-Squared	F	df1	df2	Sig
258.22	10.84	14	186	.000

Table 7. The ICC results of YUS.

Measurements	Intraclass correlation	95% Confidence Interval		F Test with True Value 0			
		Lower bound	Upper bound	Value	df1	df2	Sig
Single measurements	0.296[a]	0.271	0.322	11.074	643	14.789	.000
Average measurements	0.910[c]	0.899	0.919	110.074	643	14.789	.000

Table 8. Cronbach's Alpha coefficients for YUS.

Dimension	Number of items	Item numbers	Cronbach alpha
PU	9	S34, S22, S23, S38, S21, S40, S35, S24, S25	89.1
UA	6	S12, S3, S10, S1, S9, S2	82.9
PEU	5	S18, S17, S15, S26, S27	81.8
BI	5	S31, S30, S42, S29, S28	76.2
All Scale			91.0

Table 8 showed that Cronbach Alpha coefficients obtained for each sub-dimension in the result of factor analysis were quite high. According to the data, the internal consistency and reliability of the scale are extremely good (Murphy and Davidshofer,1998, Nunnally, 1978). There are various expressions for the Cronbach Alpha coefficient in the literature. According to Table 8, Cronbach's Alpha coefficient for the overall scale is 0.91. All Cronbach's alpha coefficients were above 0.7 and these are at an acceptable value (Bland and Altman, 1997, Reynolds et al., 2006). As a result of the reliability analysis, no item was removed from the scale.

Confirmatory factor analysis (CFA)

In this stage, the data of a sample group of 311 students who did not participate in EFA for CFA were used. Before starting the CFA, each item was checked for missing data. AMOS 24.0 program was used to determine the fit-level between the factor structures. The analysis of the data was provided by applying MLM. Structural equation modeling, which is a method used in research such as psychology, sociology, educational research, political science, and marketing, is a hybrid model of factor analysis and regression analysis (Dow et al., 2008). It analyzes the conformity of the estimated covariance matrix created according to the theoretical model to the covariance matrix of the observed data (Hox and Bechger, 1995). It is used in determining the construct validity of a data group and checking the hypotheses developed for the relations between the variables (Tabachnick and Fidell, 2014). The extent to which predetermined models explain the data is determined by the fit statistics. Many fit statistics test the fit of the models. These statistics analyze the fit of the parameters of the proposed models and the statistics obtained from the sample data. If the model does not fit the data, the hypothesis is rejected. If the proposed model cannot be rejected, the model is capable of explaining the underlying causal structure of the observed data (Özdamar, 2010).

First-order confirmatory factor analysis

First-order confirmatory factor analysis incorporates the relationship between the established factors into the model. The path diagram of CFA designed for the data-model fit of factor structure, obtained from the EFA is given in Figure 1.

As a result of the necessary modifications, it was observed that there were six items under the UA sub-dimension, eight items under the PU sub-dimension, five items under the PEU sub-dimension, and five items under the BI sub-dimension. Accordingly, item S25 with the lowest factor load value in the EFA analysis was removed from YUS. The covariance value of all sub-dimensions was found to be statistically significant. When the standardized covariance value was examined, it was found that the items with the highest effect on dimensions UA, PEU, BI, and PU was S3, S18, S31, and S22, respectively.

CFA provides information on the level at which all individual items in the YUS represent their latent variable. Table 9 shows all standardized values obtained from the first-order model diagram via the AMOS 24.0 program using MLM. These standardized values provide information on the extent to which each item is a good representative of its latent variable (Bayram, 2013). From Table 9, it was seen that all standardized factor loadings were quite high. According to this, it can be said that the proposed model is within the fit limits and at an acceptable level. As a result of CFA, the Cmin /df value of the measurement tool consisting of 24 items was found to be 1.251 (Cmin: 305 df: 244, $p < .05$). According to Kline (2011), the proposed model is perfect if the Cmin /df value is below 2. If the result is below 5, the model is at an acceptable level. In addition, to determine the degree of fit between the model and data, other goodness-of-fit indices such as Normed Fit Index (NFI ≥0 .95, goog; Bentler and Bonett, 1980), Comparative Fit Index (CFI≥0.97, good; Hooper et al. 2008), Goodness of Fit Index (GFI ≥ 0.90, acceptable; Schermelleh-Engel and Moosbrugger, 2003), Adjusted Goodness of Fit Index (AGFI ≥ 0.90, good; Schermelleh-Engel and Moosbrugger, 2003), Relative Fit Index (RFI≥0.90, good; Schermelleh-Engel and Moosbrugger, 2003), Root Mean Square Error of Approximation (RMSEA ≤0.005, good; Hooper et al., 2008, Browne and Cudeck, 1993), Standardized Root Mean Square Residual (SRMR ≤ 0.005, good; Schermelleh-Engel and Moosbrugger, 2003) were determined. Accordingly, RMSEA, SRMR, GFI, AGFI, NFI, CFI and RFI index was found to be 0.028,

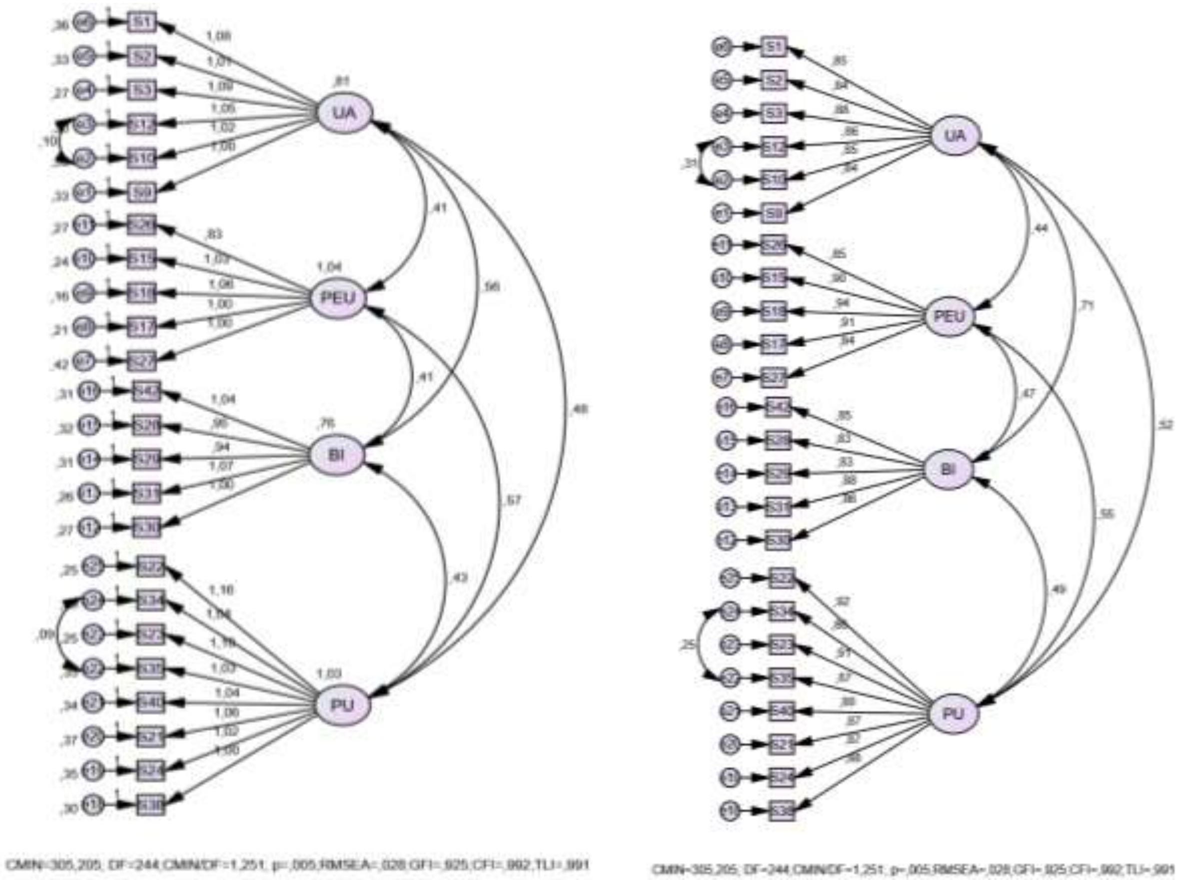

Figure 1. unstandardized and standardized factor loads in path diagram of YUS.

Table 9. First-order confirmatory factor analysis for all sub-dimensions.

Items		Latent variable	B_0	B_1	SH	CR	*p*
S9	<---	UA	0.842	1			
S10	<---	UA	0.847	1.017	0.054	18.752	<.001
S12	<---	UA	0.865	1.052	0.054	19.453	<.001
S3	<---	UA	0.885	1.095	0.054	20.294	<.001
S2	<---	UA	0.844	1.009	0.054	18.739	<.001
S1	<---	UA	0.851	1.082	0.057	18.972	<.001
S27	<---	PEU	0.843	1			
S17	<---	PEU	0.913	0.996	0.045	21.903	<.001
S18	<---	PEU	0.937	1.059	0.046	23	<.001
S15	<---	PEU	0.904	1.025	0.048	21.527	<.001
S26	<---	PEU	0.852	0.825	0.043	19.342	<.001
S30	<---	BI	0.86	1			
S31	<---	BI	0.877	1.069	0.052	20.57	<.001
S29	<---	BI	0.831	0.944	0.05	18.702	<.001
S28	<---	BI	0.825	0.946	0.051	18.489	<.001
S42	<---	BI	0.854	1.045	0.053	19.628	<.001
S38	<---	PU	0.882	1			
S24	<---	PU	0.868	1.018	0.046	21.992	<.001
S21	<---	PU	0.872	1.064	0.048	22.224	<.001
S40	<---	PU	0.877	1.04	0.046	22.456	<.001

Table 9. Continues.

S35	<---	PU	0.87	1.033	0.047	22.093	<.001
S23	<---	PU	0.912	1.101	0.045	24.561	<.001
S34	<---	PU	0.861	1.038	0.048	21.61	<.001
S22	<---	PU	0.921	1.162	0.046	25.216	<.001

β_0: standard covarians values, β_1: non-standardized covarians values, SH: Standard error, *p < .001 significant level.

0.028, 0.925, 0.908, 0.961, 0.992, and 0.956, for model-data fit, respectively. These values supported the proposed four-factor model theoretically and statistically. Accordingly, the results revealed that the model and data had a good fit.

Convergent and discriminant validity

A first-order confirmatory analysis was carried out to reveal the interrelationships between the variables. Accordingly, the covariance values between the UA, PU, BI, and PEU variables were found to be at an acceptable and significant level (Tablo 10). Accordingly, convergent and discriminant validity is performed to determine whether the observed variables are part of the latent constructs (Fornell and Larcker, 1981). Here, discriminant validity shows whether the observed variables can measure the latent variable, and convergent validity shows the relationship between the observed variables and the latent variable (Hair et al., 2010). To ensure convergent validity It should be Composite reliability (CR) > 0.70, Average shared variance (AVE) >0.50, and CR>AVE. In addition, to ensure discriminant validity it should be Maximum shared variance (MSV) <AVE and Average shared variance (ASV) < AVE. However, the square root of the AVE value should be greater than the correlation value between the variables (Bagozzi and Yi, 1988; Hu and Bentler, 1999). Composite reliability and explained mean-variance values of the variables are given in Table 10.

Table 10 exhibits that the lowest AVE value for latent variables is 0.721 and the lowest CR value is 0.928. These results demonstrated that convergent validity was provided for all latent variables in the measurement model. In the discriminant validity, MSV and ASV values were found to be smaller than the AVE values. Also, When the correlations between variables and the square roots of the AVE values are examined it was determined that discriminant validity provided for all latent variables. In addition, as a result of the analysis, both MSV and ASV value was found to be smaller than the AVE value. Finally, the results given in Table 10 were predicted as sufficient and acceptable.

Table 10. Composite reliability and explained mean-variance values of the variables.

	CR	AVE	MSV	ASV	MaxR (H)	UA	PU	PEU	BI	Cronbach's Alpha
UA	0.942	0.732	0.502	0.324	0.943	0.855[a]				0.944
PU	0.969	0.874	0.302	0.271	0.970	0.525	0.934[a]			0.966
PEU	0.950	0.793	0.217	0.209	0.956	0.442	0.550	0.890[a]		0.949
BI	0.928	0.721	0.502	0.319	0.929	0.709	0.487	0.466	0.849[a]	0.923

Note: Diagonal values (a) are the square roots of AVE values.

Testing the structural model

In this section, within the scope of TAM, the relations between the variables were tried to be revealed to examine the reflections of secondary school students' attitudes towards the use of Youtube as a learning environment in education. Therefore, the relationship between the model and structures was evaluated. Accordingly, the effect of PEU on PU and UA, the effect of PU on UA , and the effect of UA on BI were revealed. This is the basis of the TAM model. Path analysis with observed variables was used to test the mutual effects in the analysis. Figure 2 shows the non-standardized and standardized path diagram of the YouTube scale.

As a result of SEM analysis, the fit index was determined as 0.032 for RMSEA, 0.058 for SRMR, 0.922 for GFI, 0.905 for AGFI, 0.959 for NFI, 0.990 for CFI, and 0.945 for RFI. These values supported the accuracy of the proposed four-factor model. Accordingly, the results revealed that the model and the data in the model have a good fit. Parameter estimates of the analysis are given in Table 11. Table 11 showed that all standardized and non-standardized path coefficients were positive and significant.

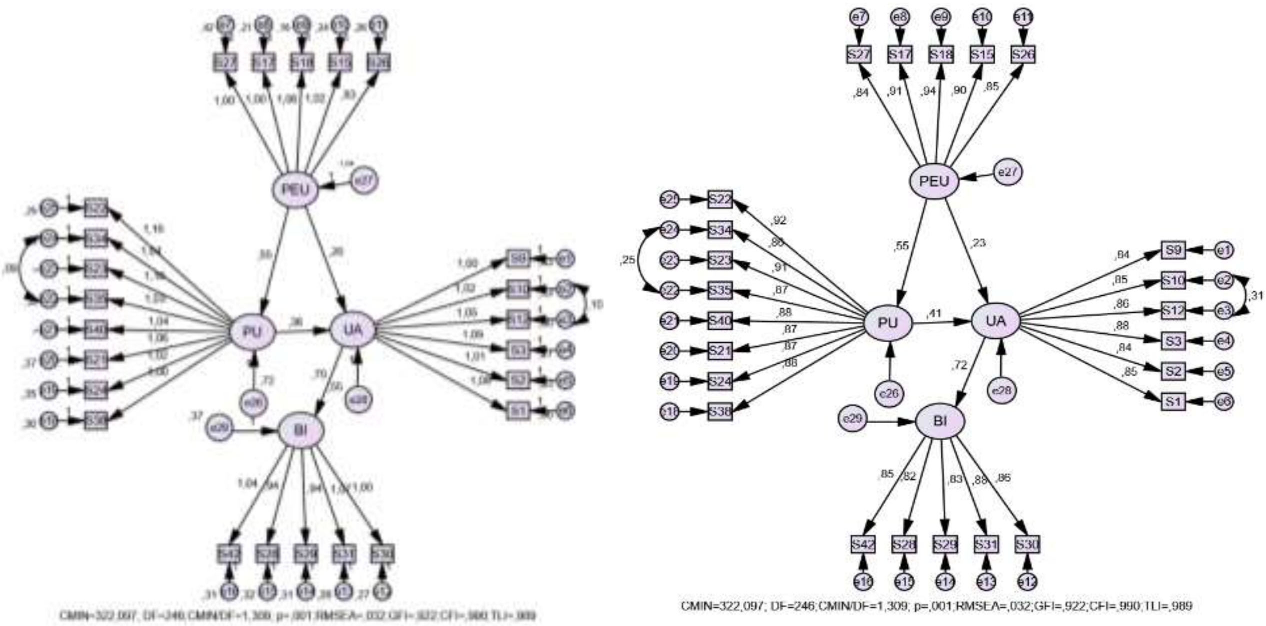

Figure 2. Non-standardized and standardized path diagram of YouTube scale.

Table 11. SEM analysis results for YouTube Scale.

Items		Latent variable	B_0	B_1	SH	CR	*p*
PU	<---	PEU	0.55	0.548	0.056	9.808	<.001
UA	<---	PEU	0.23	0.204	0.055	3.698	<.001
UA	<---	PU	0.407	0.362	0.057	6.398	<.001
BI	<---	UA	0.716	0.696	0.055	12.716	<.001
S9	<---	UA	0.842	1			
S10	<---	UA	0.847	1.017	0.054	18.755	<.001
S12	<---	UA	0.864	1.052	0.054	19.451	<.001
S3	<---	UA	0.884	1.094	0.054	20.264	<.001
S2	<---	UA	0.844	1.008	0.054	18.716	<.001
S1	<---	UA	0.85	1.081	0.057	18.963	<.001
S27	<---	PEU	0.844	1			
S17	<---	PEU	0.913	0.996	0.045	21.94	<.001
S18	<---	PEU	0.936	1.058	0.046	22.993	<.001
S15	<---	PEU	0.904	1.025	0.048	21.539	<.001
S26	<---	PEU	0.853	0.825	0.043	19.379	<.001
S30	<---	BI	0.862	1			
S31	<---	BI	0.876	1.067	0.052	20.604	<.001
S29	<---	BI	0.83	0.942	0.05	18.719	<.001
S28	<---	BI	0.824	0.943	0.051	18.482	<.001
S42	<---	BI	0.854	1.043	0.053	19.68	<.001
S38	<---	PU	0.881	1			
S24	<---	PU	0.868	1.018	0.046	21.987	<.001
S21	<---	PU	0.872	1.064	0.048	22.208	<.001
S40	<---	PU	0.877	1.04	0.046	22.45	<.001
S35	<---	PU	0.87	1.033	0.047	22.079	<.001
S23	<---	PU	0.912	1.102	0.045	24.563	<.001
S34	<---	PU	0.861	1.038	0.048	21.59	<.001
S22	<---	PU	0.922	1.163	0.046	25.209	<.001

Table 10. Continues.

SEM							
PU	<---	PEU	0.55	0.548	0.056	9.808	<.005
UA	<---	PEU	0.23	0.204	0.055	3.698	<.005
UA	<---	PU	0.407	0.362	0.057	6.398	<.005
BI	<---	UA	0.716	0.696	0.055	12.716	<.005

β_0: standard covarians values, β_1: non-standardized covarians values, SH: Standard error, *p < .001 significant level.

CONCLUSİON

This study aims to develop a valid and reliable measurement tool to measure secondary school students' attitudes towards YouTube as a learning environment. The study was formed from the scope and construct validity stages of the YUS.

For Subproblem 1, The content validity of the draft YUS was provided by taking the opinion of a group of experts in the field in line with the recommendations of Polit and Beck (2006). Expert opinion on content validity was created from the following stages. These are *i*-preparing the content verification form, *ii*-choosing a review panel consisting of expert staff, *iii*- verifying the content, *iv*-examining the fields and items, *v*-providing the score for each item, *vi*- calculating CVR, I-CVI, and S-CVI scores. In the preparation of the content verification form, 47 items were written that secondary school students can express their attitudes about YouTube usage. Then, the expert group of 14 experts was asked to express their opinions about each item on issues such as the simplicity of the test language, test organization, the adequacy of the number of items, and the inadequacy of the items in the draft YUS. The scoring of the feedback was carried out according to Yusoff (2019)'s scaling-scoring system. As a result of scoring, 5 items with a kappa value of 0.48 and below were removed from the draft YUS. The CVI/Ave and S-CVI/UA values of the 42-item draft YUS were found to be 0.93, and 0.84. No item was removed from the draft form during the face validity phase. EFA and SEM were used in construct validity studies.

For Subproblem 2, the construct validity of the draft YUS was provided through a pilot application with 644 students consisting of 5th, 6th, 7th, and 8th-grade secondary school students. The suitability for the normal distribution of the data was decided by using the statistics of kurtosis and skewness from analytical methods. As a result of the application, the skewness and kurtosis coefficients were calculated as 0.421 ± 0.096 and -0.019 ± 0.192. It has been observed that these values are in the range of -2+2 (George and Mallery, 2010). In EFA, KMO and Bartlett Sphericity Tests were performed to check the conformity of the data to the factor analysis. The significant Bartlett test of sphericity showed that the relationship between the items was sufficient for factor analysis ($\chi 2$ = 6516.14, df = 300, p < 0.01). In addition, the KMO was found close to 0.927, indicating an excellent relationship between the variables (Altunışık et al, 2012). İn EFA, within the framework of the TAM, It was decided that the data set would consist of four sub-dimensions. MLM was used as a factor extraction method in EFA because it is parallel to CFA. While Varimax was used to perform the rotation, the Listwise Selection method was preferred to extract the missing data. As a result of the analysis, items numbered S4, S5, S6, S7, S8, S11, S13, S14, S16, S19, S20, S32, S33, S36, S37, S39, and S41 were excluded from the draft YUS. In this way, 42 items in the draft YUS were reduced to 25 items. In addition, the scree graph was also used to determine the number of factors. It was seen that the curve flattened after point 4. This showed that YUS generally consists of four sub-dimensions. According to the results of the Split half reliability analysis, which is one of the reliability analyzes of YUS, the alpha values of the first and second parts were close to each other. This result showed that the items were sequential and reliable. Similarly, the correlation value between forms, Guttman Split Half result, and equal and unequal Length Spearman-Brown values were determined as 0.797, 0.887, and 0.887, respectively. The results showed that the reliability of the measurement tool was quite high. In addition, Cronbach's Alpha coefficient for the 25-item test was found to be 0.91. Also, ANOVA was carried out to determine the homogeneity of the items and their relationship with each other. The results showed that YUS was a Likert-type additive scale in terms of options and scoring (Özdamar, 2019). After that Hotelling's T-Squared analysis was performed. Accordingly, the YUS consists of homogeneous, strong, and unique items. Also, YUS is effective in measuring (Özdamar, 2019).

On the other hand, according to the ICC results of the YUS, both the variances and the total variances of the two half-tests were similar. From this point of view, when the sequence and structural features of the items are taken into consideration, YUS is a valid and reliable measurement tool. According to these results, in terms of both single measurements and average measurements, YUS is reliable and its internal consistency is extremely high. The data of a sample group of 311 students were used in the structural equation modeling of YUS. First-order confirmatory factor analysis was carried out to determine the correlation between latent variables and the compatibility of items with latent variables. Accordingly, the model-data fit index was determined as

RMSEA: 0.032, SRMR: 0.058, GFI: 0.922, AGFI: 0.905, NFI: 0.959, CFI: 0.990 and RFI: 0.945. These values supported the accuracy of the proposed four-factor model. An item in the EFA was excluded from the CFA structure. Accordingly, it was observed that there were 6 items under the UA, 8 items under the PU, 5 items under the PEU, and 5 items under the BI. The covariance values of latent variables were found to be statistically significant. In convergent and discriminant validity, it was found that the lowest AVE value for latent variables was 0.721 and the lowest CR value was 0.928. These results demonstrated that the convergent validity provided for all latent variables in the measurement model. Also, MSV, ASV, and AVE values provided discriminant validity for all latent variables. In the last part of the study, the relationship between the model and the constructs was examined with second-order confirmatory factor analysis. As a result of SEM analysis, fit ındex was found to be RMSEA: 0.032, SRMR: 0.058, GFI: 0.922, AGFI: 0.905, NFI: 0.959, CFI: 0.990 and RFI: 0.945. Accordingly, the results revealed that the model and the data have a good fit. In addition, it was determined that all standardized and non-standardized path coefficients were positive and significant.

Youtube is known to be the most popular video-sharing platform in the world (Smith, 2020). Platforms with educational video content such as Youtube can offer more effective learning because they appeal to more senses than written sources and facilitate the user to establish visual contexts. Within the scope of education and lifelong learning, it has been seen in some studies that Youtube as a video learning tool has potential benefits due to its popularity and easy access (Gülbahar et al., 2010; Guo et al., 2014; Jones and Cuthrell, 2011). It has also been reported in the literature that the purposes of choosing video content on Youtube may differ according to the Y and Z generation user groups (Gök et al., 2019).

For this reason, scale development studies on social platforms are very limited in the literature. Davis, (1989) developed a measurement tool to scale the variables of TAM as a learning resource. Recently, Chintalapati and Daruri (2017) examined the behavioral intentions of students studying in higher education according to the TAM variables. As Chintalapati and Daruri (2017) stated, although there are many studies examining the adoption of information technologies using the variables of the TAM, the items used are specific to the purpose of the study. These items are affected by many reasons such as sample group, generational differences, time, and popularity. In this study, it was found that secondary school students' technology adaptations were reflected in their behavioral intentions. Thus, in this sample group using Youtube, Technology adaptation has proven valid. Finally, a valid and reliable instrument was obtained for examining the use of YuoTube as the learning environment of generation Z secondary school students for future research.

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Citation: Doğan, F., and Balkaya, M. (2023). Scale development and validation study on the using YouTube as a learning environment in secondary education according to the technology acceptance model. African Educational Research Journal, 11(1): 1-20.

Appendix A. Attitude Scale towards YouTube usage of secondary school students.

Dimension	Code	Items	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
PU	PU1	S22: Thanks to YouTube videos, I can watch a lesson video on a subject that I missed or did not understand at school.	1	2	3	4	5
	PU2	S21: Thanks to YouTube videos, I can listen to the same lesson from different teachers.	1	2	3	4	5
	PU3	S23: YouTube helps me learn new ideas.	1	2	3	4	5
	PU4	S40: I can easily access YouTube videos on the subject via google search.	1	2	3	4	5
	PU5	S35: I learn new things thanks to educational YouTube videos.	1	2	3	4	5
	PU6	S34: I have a lot of fun watching YouTube videos for educational purposes	1	2	3	4	5
	PU7	S24: Thanks to YouTube videos, I can find answers to my questions.	1	2	3	4	5
	PU8	S38: Thanks to YouTube videos, I can repeat the lessons quickly.	1	2	3	4	5
UA	UA1	S2: I believe the information in the YouTube videos is correct.	1	2	3	4	5
	UA2	S1: I trust the information I get from YouTube videos.	1	2	3	4	5
	UA3	S12: I can find useful videos on YouTube.	1	2	3	4	5
	UA4	S9: I feel good when I use YouTube for learning purposes.	1	2	3	4	5
	UA5	S3: I am satisfied with the information I got from youtube.	1	2	3	4	5
	UA6	S10: I like to spend time on YouTube.	1	2	3	4	5
BI	BI1	S30: My success at school increases thanks to YouTube videos.	1	2	3	4	5
	BI2	S31: Thanks to YouTube videos, I can be motivated for my lessons.	1	2	3	4	5
	BI3	S29: I find the videos I watch on YouTube are sufficient for the course.	1	2	3	4	5
	BI4	S28: I am more successful when I prepare for exams by watching YouTube videos.	1	2	3	4	5
	BI5	S42: YouTube provides the opportunity to study at any time of the day.	1	2	3	4	5
PEU	PEU1	S27: I get distracted very easily while watching videos.	1	2	3	4	5
	PEU2	S18: I feel like in school watching YouTube videos.	1	2	3	4	5
	PEU3	S17: YouTube has increased my success in classes.	1	2	3	4	5
	PEU4	S15: If I stop using YouTube I may fail my studies.	1	2	3	4	5
	PEU5	S26: I can't find answers to questions in YouTube videos.	1	2	3	4	5