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DEVELOPMENT AND VALIDATION OF HIGHER SECONDARY SCHOOL STUDENT ACADEMIC ENGAGEMENT SCALE (HSSSAES)

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ABSTRACT

The development and validation of a reliable instrument to evaluate student academic engagement consisting of three dimensions i.e. cognitive, behavior, and affective) was the objective of the study at hand study. This developed instrument is referred to as the Higher Secondary School Student Academic Engagement Scale (HSSSAES). All statements were measured over a 7-point Likert scale with 1(strongly disagree) to 7 (strongly agree). The steps of the scale development and validation were followed suggested by DeVellis (2017). Students of higher secondary school were used to draw structure equation models (SEM).

The sample consisted of 1264 students (653 males and 611 females) enrolled in 9th, 10th, 11th, and 12th grade at a public, private High, and Higher Secondary school situated in the district Okara of Pakistan. Thirty-five items were developed for the questionnaire. First of all, content validity was ensured. Six items from D1 and three items from D3 were excluded by the expert opinion. Twenty-three items were analyzed through a content validity ratio. Nine items (SD1.10, SD2.4, SD2.5, SD2.8, SD2.10, SD3.4, SD3.5, SD3.6, SD3.7, SD3.8, SD3.9, SD3.10) were removed through CVR. Confirmatory Factor Analysis (CFA) was performed through AMOS to make the model fit. The α-reliability coefficient of the questionnaire (consisting of 17 items) is 0.856, which is considered a reliable measure. Eight (8) items were retained for the cognitive engagement with $\alpha = 0.78$, six (6) items retained for the Behavioral Engagement (BE) with $\alpha = 0.71$, and three (3) items for the Affective Engagement (AE) with $\alpha = 0.65$. Consequently, a questionnaire, comprising 17-item obtained. Higher Secondary School Student Academic Engagement Scale (HSSSAES) results have sufficient evidence to be a valid and reliable instrument.

KEYWORDS

Scale development, Student Engagement, Cognitive, Behavioral and Affective Engagement.

INTRODUCTION

Academic engagement leads students to become successful learners. The development of a valid and reliable scale is a critical problem that has plagued the achievement of desired objectives. There are many challenges, issues, and problems with student academic engagement. The large discrepancy in the measurement of student academic engagement

is one of the challenges. Academic engagement lays the basis for a country's social, economic, and political developments. Measuring academic engagement has always been challenging (Anthony, 2016) and controversial due to the lack of its generalizability (Alrashidi, Phan & Ngu, 2016). It is due to the complexity, unavailability of its direct assessment. Different researchers measured student academic engagement with different instruments. But the (a student self-report) questionnaire is an instrument in practice to measure the level of academic engagement. Self-report questionnaires can be used to measure cognitive and emotional engagement. A researcher can achieve valuable, valid, and reliable information about student emotional and cognitive engagement by using self-reported instruments (Appleton, Christenson, Kim, & Reschly, 2006). These methods are concerned with actual use or practice and are easy to administer in classroom settings. Valuable and diagnostic information can be achieved through large and diverse samples. Self-reported instruments make it accessible to probed at on different waves and relate consequences across schools to measure academic engagement (Collie & Martin, 2017).

Development and validation of self-report questionnaires of student academic engagement on the Likert scale are valid and reliable (Fletcher & Robinson, 2013). The values, worth, quality, and standard of the questionnaire have been measured in terms of validity, reliability, and other characteristics. This process is overlooked due to the absence of a consistent and systematic process of questionnaire development. Developed instrument referred to as the Higher Secondary School Student Academic Engagement Questionnaire (HSSSAES). This instrument may be used to collect data in other relevant studies. The instrument has been developed on a 7-point Likert scale. This instrument was developed by the researchers after reviewing the literature. The questionnaire was developed on valid and reliable factors.

LITERATURE REVIEW

Pakistan is facing a critical problem with education. Numerous aspects are responsible for this situation. Some studies emphasized the role of educational structures and values for the best level of engagement. Positive principles in the direction of learning drive student academic engagement (Zepke and Leach 2010). An important acceptable technique of increasing Academic engagement is to improve the interaction among the students. Student Academic engagement is the basic and important element of student learning. This factor has been the focus of several researchers. Student academic performance also depends upon engagement (Tyler & Boelter, 2008). In short, student, Academic engagement is a factor of learning consequences and meta-cognitive improvement (Ma, Han, Yang, & Cheng, 2015). It is also an indicator, predictor, and interpreter of student success at the secondary and a higher level of schools (Finn & Zimmer, 2012). But in measuring, is a complicated and multi-dimensional paradigm (Ben-Eliyahu, Moore, Dorph, & Schunn, 2018). Many investigators and researchers have termed it ‘meta-construct (Larsen & Bong 2016). Controversies, ongoing disagreement about its generalizability, and components are also present. Student academic engagement is an effort and energy in action that is the observable manifestation and verified through a range of indicators (Skinner & Pitzer, 2012). Student engagement is the name of physical, psychological, emotional, and mental energy that the student offers to the learning practices (Kashif & Basharat, 2014). Student academic engagement is Dynamic participation,

commitment, and courtesy of learners with learning activities (Singh, Granville, & Dika, 2002). In the same way, Charles, Bustard, and Black (2009) claimed student academic engagement is the degree of student's extent of contribution to the learning process. Student Academic engagement is self-motivated and cognitive participation for comprehending learning materials (Kuh, 2009). It is believed that student academic engagement is a multi-faced and multi-dimensional movement. It involves various factors like cognitive, behavioral, emotional, and academic (Korobova, & Starobin, 2015).

No definition exists in the literature that satisfied the stakeholders (Hollebeek, 2011). In the same way, no research can be expected that has measured each aspect of student academic engagement (Jang, Reeve, and Deci, 2010). It is also necessary to have the best definition and understanding of the desired phenomenon before conducting any study. So, according to the study at hand, student academic engagement is measured in emotional states in the shapes of feelings, interest anxiety, happiness, and anger during learning activities. Some researchers (e.g. Eccles, & Wang, Ming, 2012) identified three components (1) affective/emotional (2) cognitive (3) behavioral. In the same way, some suggested only behavioral and emotional engagements are the main features of student academic engagement (Appleton, Christenson, & Furlong, 2008). But other recommended disaffection is also a component of student engagement (Skinner, Ellen & Furrer, 2008). Some add more factors, namely societal engagement, commitment (Fredricks, Filsecker, & Lawson, 2016), and agented engagement (Reeve, 2012). Student academic engagement is measurable with cognitive, behavioral, and affective sub-constructs (Bond, Buntins, Zawacki-Richter, & Michael Kerres 2020). The maximum identified student engagement indicators (involvement, interaction, participation, achievement, and optimistic communication with teachers and peers) were categorized into three behavioral, affective, and cognitive dimensions (Bond, Zawacki-Richter, & Nichols, 2019). A lot of researchers collected the data through adopted, adapted, or self-developed questionnaires through the mentioned features of student academic engagement.

CONSTRUCTS AND MEASUREMENT OF STUDENT ENGAGEMENT

They are several hypothetical and theoretical constructs that illuminate student academic engagement. A lot of issues, problems, and challenges occurred in the process of measurement of student academic engagement. One of the issues is the construct of student academic engagement (Steele & Fullagar, 2009). There are variances across studies in terms of its assessment, measurement, theoretical, logical, and ideological definitions and engagement (Fletcher & Robinson, 2013). Student academic engagement consisted of four dimensions (1) behavioral disaffection with engagement (2) affective is affection with academic engagement (3) behavioral engagement (4) affective/ emotional engagement (Skinner & Pitzer, 2012).

In the same way, four components of student engagement (1) physical (2) emotional (3) cognitive engagement in class out of class were also recommended (Tuan, Marisa & Jason, 2016). Some researchers recommended student academic engagement in three-dimensional paradigms consisting of behavioral, emotional/affective, and cognitive (Lane & Harris 2015). The majority of the studies showed all three aspects of behavioral engagement, cognitive engagement, and affective engagement, (Szabo & Schwartz, 2011).

Based on mental, psychological, emotional, and educational literature, researchers synthesize engagement into three aspects namely behavioral, affective, and cognitive (D'Mello, Dieterle, Duckworth, 2017).

Cognitive Engagement

The level of students' participation and contribution in learning is cognitive engagement. It is a psychological investment that ranges from memorization to a deep understanding of any phenomenon. Quality education depends upon the level of cognitive engagement. Cognitive engagement is the name of thinking and sophisticated effort about the learning material while being observed (Chi, Adams, Bogusch, Bruchok, Kang, Lancaster &Yaghmourian, 2018). Student cognitive engagement comprises a sympathetic and planned willingness to apply the necessary struggle for an understanding of the multifaceted and complex ideas (Fredricks, Blumenfeld, & Paris, 2004). Researchers claimed that cognitive engagement is the effortful usage of cognitive and self-regulated learning strategies in learning (Greenwood, & Kelly, 2019). But this definition indicates an intersection and overlapping between the research on self-regulation and academic engagement. Cognitive approaches and strategies are used in the definitions of student self-regulation. Self-regulation is a fundamental key process and detailed description of an integrated framework for learning that emphasizes learners' academic engagement (White & Di Benedetto, 2015). Furthermore, it is also claimed that cognitive engagement is the name of students' self–regulated or use of self-regulated learning strategies. A little practical difference between student engagement and cognitive features of self-regulated learning was observed (Wolters and Taylor, 2012). In response, it will be valid and appropriate to include reasoning, intellectual, cognitive strategies, self-regulation, and cognitive engagement practices.

Behavioral Engagement

Behavioral engagement is a dependent situation that involves the student in task-related activities. It is directly associated with the learning procedure, starting with a continuous spectrum of concentration. Behavioral engagement starts with obedience, compliance, effort, hardworking, and taking the initiative in academic activities (Sinatra, Heddy, & Lombardi, 2015). There is a significant and strong relationship between behavioral and cognitive engagement (Luo, Hughes, Liew & Kwok, 2009). It is the main link between offered learning opportunities and actual learning situations (Skinner, Kindermann, & Furrer, 2009). It revolves the concept around student participation, attendance, intellectualized effort attention, action initiation, and time on task.

Behavioral engagement is a supposed and soft receptive to the disparity in the context and intimately linked to the individual's settings (Fredricks, Filsecker, &Lawson, 2016). Although it is the students' constantly fluctuating state sensitive to situational factors. This fluctuating state can be impressed by the task of fellows, peers, educators, and the learning environment. In the same way, time of the day and classroom atmosphere is the main feature of this influencing context.

The Behavioral factor is the most important factor of academic engagement (Lee, 2012). Behavior is a central indicator of student academic engagement in class. In the same way, affective and cognitive engagement also plays a critical role in managing academic

engagement. In an educational context, behavioral engagement is student participation in learning-related activities. Behavioral engagement consisted of student participation in the school or participation within the classroom (Fredricks, Blumenfeld & Paris, 2004).

Affective Engagement

Student emotional engagement is also called an effective engagement (Rebecca, Arlene, Philip & Phil, 2017). Behavioral theorists noted different factors of emotional engagement (D'Mello, Dieterle, Duckworth, 2017). Motivation is self-determination and the control-value theories of emotions. It highlights how positive and negative emotions are generated during the learning process. Student academic emotional engagement comprises feelings, interest, belonging, value, and positive sensations. Emotional engagement comprises interest, enthusiasm, pleasure, satisfaction, confidence, pride, hope, and vitality (Pekrun & Linnenbrink-Garcia, 2012). However, Fredricks, Blumenfeld, and Paris (2004) make an addition by combining positive, constructive, and (undesirable) negative emotions in their definition of affective academic engagement. Student energized affective (emotional) states such as passion, concentration, and enjoyment is emotional engagement. Academic emotion and student engagement in learning overlap. But the Circumplex Model of emotions (Figure 1) clears where overlap occurred between academic emotions and academic engagement. All of the positive emotions including enthusiasm, interest, satisfaction, and enjoyment are helpful in academic engagement (Renninger & Bachrach, 2015).

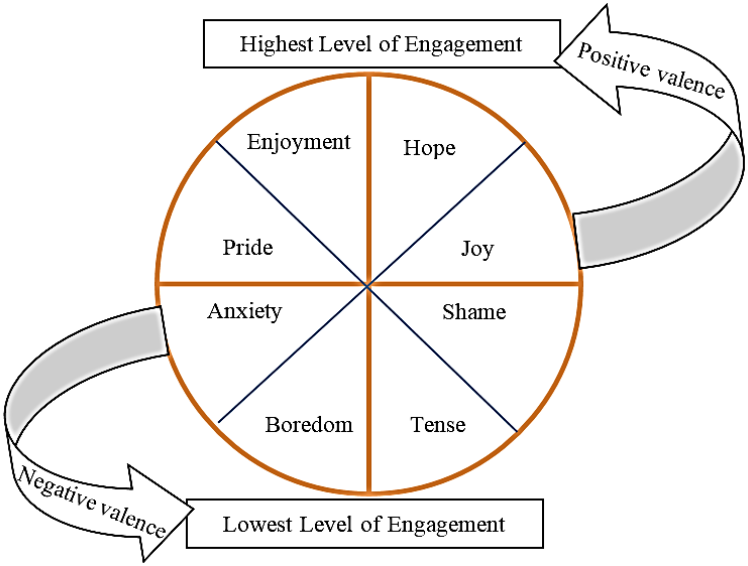

Figure 1: Circumplex Model of Emotions

The behavioral factor is in the figure Circumplex model of emotions, divided into positive and negative valence. Just positive, exciting, and stimulating emotions are in the upper quadrant. Pekrun and Linninbrink-Garcia, (2012) claimed that emotions are considered equivalent to emotional engagement because these provide fuels for academic

engagement. In Figure 1, the Academic emotions circumflex model was adapted from Pekrun and Linnenbrink-Garcia (2012). A significant relationship among higher secondary school students' behavioral, cognitive, and affective engagement was found (Nazamud-din, Zaini, & Jamil 2020). Though, Pekrun and Stephens (2010) claimed that limited values were given to higher secondary level student academic engagement research. In the same way, cognitive psychologists (Immordino-Yang, 2011) emphasize more research and theory to "understand how best to illustrate, capitalize and characterize the constructs of learning at the secondary level student. Viewed literature addresses their search gap with the measurement of behavioral, cognitive, and affective engagement.

METHODOLOGY

Different types are adopted to develop an instrument for the measurement of the models, hypotheses, or paradigms like Student Engagement. These methods are the Thurston scale, Likert type attitude scale, Bogardus social distance scale, Guttman scales, and Osgood emotional meaning scale (Balasubramanian 2012). But Likert scales are a comparatively unique scaling technique (Joshi, Kale, Chandeland Pal 2015). These scales are unidimensional that measure characteristics of a single thing or trait. Thurston's method of development and validation of the scales (equal appearing intervals scale) and Likert's method of scale development are important and known by the names of their prescribers (Trivedi, 2007). These methods are also called the method of summated rating methods. The Likert method is an important method. Likert Scales are popular and easy to use (Joshi, Kale, Chande land Pal 2015). Researchers of the study at hand followed the Likert scale technique of development and validation. The reason to follow this method is its adequacy, suitability, acceptability, popularity, and ease of use. The construction and uses are less harder than Thurstan's techniques (BoatengGO, Martin, Collins & Natamba, 2018). Moreover, the Likert-type scale is the most commonly used method in the process of development and validation of scale (Prados, 2007). No judges are required to use comparatively fewer statistical rules in contrast to other scaling techniques, (Ary, Jacobs & Razavieh, 2006). Moreover, psychologists, experts, and educationists' opinions were in the favor of the Likert method. Furthermore, steps of scale development and validation were suggested by De Vellis (2017). Through these scales, participants are requested to point out their level of satisfaction with the statement. Moreover, seven-point scales are comparatively easy to use.

Though the level of satisfaction is relatively quick to use, scales 7-point are much preferred to gain respondents' spirits, moods, and feelings adequately. Furthermore, 7-point Likert is the most preferred rating scale. Several studies claimed that 7-point scales convey more useful information. Seven-point scales are more likely to reflect participants' true subjective evaluation of usability questionnaire statements than five-point options. Furthermore, it was suggested that this method is well-organized and effective for developing a valid and reliable scale. The Likert method has been liked due to its high reliability and effectiveness. After this, researchers reviewed eleven self-report scales. These scales were used in measuring student academic engagement in a different context. Across these eleven scales, researchers noted scales name, items use of scales, samples, validity, and reliable information available on each measurement.

Item Development

Thirty-five items (D1 = 15, D2 = 10, D3 = 10) were developed based on the literature for this questionnaire. Furthermore, suggestions of different authors (like DeVellis 2017: DeJong, van Leeuwen, Hoek strand Vander Zee 2014) were also kept in mind while developing these items. Thirty-five items about Higher Secondary School Student Academic Engagement were tried-out through the different processes of tool development.

Face Validity of Higher Secondary School Student Engagement Scale (HSSSAES)

Face validity of HSSSAES was also ensured by the experts' opinions. Face validity means prima facie (Latin word meaning first sight) assessment of whether the statements show an illustrative and representative shape on the paradigm and whether this instrument seems valid. Content validity was also confirmed.

Items Development Process and Experts' Opinion

Different experts were invited in the process of item Content Validity Ratio of the Higher Secondary School Student Engagement Scale (HSSSAES). It was decided to understand quite relevant and relevant equal to very relevant and the process of CVR. After the development of items, a team of experts inspected the content validity of all of these statements/items.

Content Validity through Experts' Opinions

This instrument was given to five (5) experts from different institutions having different experiences. These experts are labeled as follows:

- Experts A, B, and C: Experts in quantitative and qualitative research from the University of Okara.
- Expert D: Expert in quantitative research from the University of Gujrat.
- Experts E: Expert in quantitative research from the University of Management and Technology Lahore.

All the experts have completed their doctorate degrees in the field of education. A copy of this scale with observed variables was given to the experts. Experts have cleared the aim and objectives of the study. It was requested to evaluate each item based on relevance, clearness, simplicity, and uncertainty. Here experts have to give narrating of 4 = very Suitable, 3 = quite Suitable. In the same way, rating 2 = somewhat Suitable, 1 = not Suitable. For further details see Table 1.

Table 1
Expert Opinions about Statements

Item No	Not Suitable	Somewhat Suitable	Quite Suitable	Very Suitable
SD1.1	4	2	×	×
SD1.2	3	1	1	**1**
SD1.3	3	2	×	×
SD1.4	4	1	1	×
SD1.5	3	2	1	×
SD1.6	3	3	×	×
SD1.7	×	×	1	5
SD1.8	×	×	1	5
SD1.9	×	×	1	5
SD1.10	3	2	**1**	×
SD1.11	×	×	1	5
SD1.12	×	×	1	5
SD1.13	×	×	2	4
SD1.14	×	×	1	5
SD1.15	×	×	1	5
SD2.1	×	×	1	5
SD2.2	×	×	2	4
SD2.3	×	×	2	4
SD2.4	3	2	**1**	×
SD2.5	4	1	**1**	×
SD2.6	×	×	2	4
SD2.7	×	×	2	4
SD2.8	3	3	×	×
SD2.9	×	×	2	4
SD2.10	2	4	×	×
SD3.1	×	×	1	5
SD3.2	×	×	1	5
SD3.3	×	×	1	5
SD3.4	3	2	×	1
SD3.5	3	2	×	1
SD3.6	2	3	×	1
SD3.7	3	2	×	1
SD3.8	2	2	1	1
SD3.9	2	2	1	1
SD3.10	2	2	1	1

N=6, S=statement, D=section name

STATISTICAL PROCEDURE

Further it was suggested to check all the items through formula

CVR= [(Nvr-(N/2))/N/2)] (Ayre, & Scally, 2014).

In this formula Nvr mean number of experts whom rated the statement very relevant and N = no of experts in panel.

Procedures of the Content Validity Ratio (CVR)

Content validity of the Higher Secondary School Student Engagement Scale measured by quantitative measurement procedure. The researchers investigated the consequences of the content validity of the statements in the Higher Secondary School Student Engagement Scale. The statement that has CVI>0.80 remained and deletion as the case may be. Each statement's Content Validity is calculated as the number of experts given as core of either 4 to 1, divided by the total of experts. Therefore, based on the mean result and item shaving CVR<0.80 will be removed. A copy of the instrument was given to the board of experts for further assessment. Content Validity Ratio (CVR) values near + 1 indicate that the experts agree and this item is in the content validity. It is also considered to satisfy face validity. If CVR is less than 1 or in minus, then the item has failed to meet the minimum value and is statistically insignificant (Lewis, Templeton & Byrd 2005). Then this item will automatically be dropped.

Table 2
Item-based Content Validity Ratio (CVR)

Item No	Statement	CVR	Mean	Decision
SD1.1	Ialwaystrytobestunderstandingofthematerialbyrelatingittheexistingknowledge	-1.00	1.33	Removed
SD1.2	I try to know how the information is useful in the real world	-0.68	1.67	Removed
SD1.3	During learning, I try to explain the knowledge in my own words	-1.00	1.50	Removed
SD1.4	During study, I try to attach what I am learning through my own practices	-1.00	1.50	Removed
SD1.5	I set make own illustrations to understand the concepts	-1.00	1.67	Removed
SD1.6	If there is any difficulty in home work, I keep working on it until it is solved	-1.00	1.50	Removed
SD1.7	I like assigned individual activities	1.00	3.83	Agreed
SD1.8	I measure parts of my learning process	1.00	3.67	Agreed
SD1.9	I use all of the necessary supplies	1.00	3.83	Agreed
SD1.10	I enjoy thinking critically	-0.67	1.67	Removed
SD1.11	When studying in class, I feel energetic	1.00	3.83	Agreed

Item No	Statement	CVR	Mean	Decision
SD1.12	I like my studies challenges	1.00	3.83	Agreed
SD1.13	In class I like analyzing ideas in-depth in the class	1.00	3.67	Agreed
SD1.14	I think about the future consequences of my learning	1.00	3.83	Agreed
SD1.15	I make plant or each the desired goal	1.00	3.83	Agreed
SD2.1	I obey my school's rules and regulation	1.00	3.83	Agreed
SD2.2	I like the work which I learn in school	1.00	3.67	Agreed
SD2.3	I enjoy learning new knowledge in class	1.00	3.67	Agreed
SD2.4	I enjoy the time outside the classroom	-0.33	1.67	Removed
SD2.5	I am proud for being at school	-0.33	1.50	Removed
SD2.6	I feel safe and sound in class	1.00	3.67	Agreed
SD2.7	I willingly help my teacher in developing classroom rules	1.00	3.83	Agreed
SD2.8	I happily obey the established rules	-0.33	1.50	Removed
SD2.9	My teachers respect my ideas	1.00	3.83	Agreed
SD2.10	I use the class time effectively	-1.00	1.67	Removed
SD3.1	I pay attention during class work	1.00	3.83	Agreed
SD3.2	I am a hard worker to do well in class	1.00	3.83	Agreed
SD3.3	I participate in classroom activities	1.00	4.00	Agreed
SD3.4	I play an active role in extra-curricular activities	-0.33	1.83	Removed
SD3.5	I voluntarily help to arrange the activities	-0.33	1.83	Removed
SD3.6	Mistreatment effects on my learning process	-0.33	1.83	Removed
SD3.7	I pay attention to class work	-0.33	1.83	Removed
SD3.8	My studies is purpose full	-0.33	1.83	Removed
SD3.9	My studies is meaning full	-0.33	1.83	Removed
SD3.10	I keep myself up to date with my studies	-0.33	1.83	Removed

N=6

It was decided to remove all that items (SD1.1, SD1.2, SD1.3, SD1.4, SD1.5, SD1.6, SD1.10, SD2.4, SD2.5, SD2.8, SD2.10, SD3.4, SD3.5, SD3.6, SD3.7, SD3.8, SD3.9, and SD3.10) which have low mean and negative content validity ratio (CVR).

Data Collection

The population of the study at hand comprised all the students enrolled in grades 9th, 10th, 11th, and 12 thin government higher secondary schools situated in Punjab Province. There were 1264 students including 653 males and 611 females enrolled in grades 9th, 10th, 11th, and 12th. The researchers used a simple random sampling technique for the data collection process. A survey was conducted for data collection. Participants were free to indicate their level of engagement, whether they are Strongly Agree, Agree, Somewhat Agree, Undecided / Natural, Somewhat Disagree, Disagree, Strongly Disagree with each item or statement. Seventeen items about Higher Secondary School Student Academic Engagement remained were tried-out.

Final Version of Higher Secondary School Student Academic Engagement Scale

Higher Secondary School Student Academic Engagement Scale was developed on 7 points Likert Scale. The data were collected from the higher secondary school student on whether they strongly agree or strongly disagree with the items. Participants have to select one of the following options:

1 = Strongly Disagree, 2 = Disagree, 3 = Somewhat Disagree,
4 = Undecided, 5 = Somewhat Agree, 6 = Agree, 7 = Strongly Agree.

Most of the statements were constructed positively, whereas some were structured negatively. At the time of the statistical procedure, all negative statements were re-coded.

Higher Secondary School Student Academic Engagement Scale to identify and measure Academic engagement. Internal consistencies of all the sub-factors and over the entire Questionnaire reflected reasonable results.

The present results were also consistent with the conclusions of the authors of the original version in that the three-factor structure of the Higher Secondary School Student Academic Engagement Scale (HSSSAES) found sufficient support in CFA. Confirmatory factor analysis (CFA) was performed through SPSS version-24. Factor-loading less than 0.5 items were deleted from the instrument. Similarly, AMOS software was also used for confirmatory factor analysis to make the model fit.

Model Fit of Confirmatory Factor Analysis (CFA)

Nine statements were removed through a Model fit of Confirmatory Factor Analysis (CFA). Model fit of the "Confirmatory Factor Analysis (CFA)" approach is used to validate the structure of the instruments. It helps in determining the probability of the correlation between the variables observed and their Latent constructs. Many fit indices can use to determine the model fit. The researchers have used the Comparative Fit Index (CFI), Goodness of Fit (CMIN), Adjusted Goodness of Fit Index (AGFI), the Tucker-Lewis Index (TLI), the Standardized Regression Weights, Chi-Square ($\chi 2$), and the Root Mean Square Error of Approximation (RMSEA). Recommended minimum standards of a model good fit for the mentioned metrics are: CFI $\geq$0.90, AGFI $\geq$ 0.90, CFI > 0.90, and close to 1,

TL I ≥ .90, RMSEA ≤ 0.08 is accepted however less than 0.05 is good, SRMR ≤ 0.08 (Steiger & James 2007). Thus, Confirmatory factor analysis (CFA) was run through AMOS software, and the values were calculated, accordingly.

Confirmatory Factor Analyses were conducted with the recommended alignment of Brown (2006). This statistician claimed that Confirmatory Factor Analyses are valuable in confirming the (elements) component/factors and the association between statements and factors of instruments. The researchers analyzed CFA by using AMOS Version 26™. Confirmatory Factor Analyses do not allow for missing data (N = 1264) so missing values were changed with the help of means. Researchers calculated the model based on the (CFI) comparative fit index, (RMSEA) root mean square error of approximation, (TLI) Tucker Lewis index, and Standardized Root Means Square Residual (SRMR) model fit measurements. Recommended standards of a model good fit by McNeish and Hancock (2018) mentioned metrics are CFI greater than 0.977, TLI greater than 0.95, RMSEA greater than 0.06, and SRMR greater 0.08.

MODEL FIT SUMMARY

Table 2
Criterion Values for Confirmatory Factor Analysis

Model	NPAR	CMIN	DF	P	CMIN/DF
Default Model	27	174.818	50	.000	3.56
Saturated Model	79	.000	0		
Independence Model	13	3170.020	65	.000	47.03

Some researchers agree CMIN / DF < 3 and Good; <5: Moderate (Aynalem, Getasew 2020). The value ≤ 5 is acceptable for a model fit and good. Similarly, Paswan (2009) preferred below 2 but between 2 and 5 acceptable. Table 2 shows the value of the CMIN / DF ratio is near 4, i.e., 3.56. So, the value less than 5 will be permissible for Model Fit and meet the criterion of Model Fit (Hair, Black, Babin, Anderson, & Tatham, 2010). All the measurements model of this study (Table 2) is acceptable.

Table 3
RMR, GFI Model

Model	RMR<.09	GFI>0.85	AGFI>0.80	PGFI
Default Model	.096	.977	.965	.610
Saturated Model	.000	1.000		
Independence Model	.722	.550	.465	.460

The smallest and near to zero value of the RMR (root mean square residual) indicates a perfect fit model. GFI > 0.9 means satisfactory fit and value > 0.80 suggests a good fit (Bollen & Curran, 2006). Adjusted Goodness of Fit Index (AGFI) value was examined at 0.965 which was found above the criterion value i.e. 0.90. However, the standard-setting for the set wise > 0.90 (Hairetal, 2010). This value meets the criterion of Model Fit. Resulted values are (reported by AMOS) GFI = 0.977 and AGFI = 0.965. Therefore, it is accepted for model fit.

Table 4
Standardized Regression Weights of items of HSSSAE

Items		Factors No	Estimate Regression
SD1.7	<---	D1	0.528
SD1.8	<---	D1	0.486
SD1.9	<---	D1	0.457
SD1.11	<---	D1	0.477
SD1.12	<---	D1	0.611
SD1.13	<---	D1	0.625
SD1.14	<---	D1	0.628
SD1.15	<---	D1	0.598
SD2.1	<---	D2	0.577
SD2.2	<---	D2	0.584
SD2.3	<---	D2	0.539
SD2.6	<---	D2	0.516
SD2.7	<---	D2	0.534
SD2.9	<---	D2	0.518
SD3.1	<---	D3	0.59
SD3.2	<---	D3	0.751
SD3.3	<---	D3	0.565

Standardized regression weights measure comparisons between related parameters within a single model (Thompson, 2007). However, the estimated inter-item correlation is significant (value of all items p >. 05). It should be noted that the p-value was close to statistical significance (exactly. 052).

Table 5
Baseline Comparisons

Model	NFI Delta1	RFI Rho 1	IFI Delta 2	TLI Rho 2	CFI
Default Model	.945	.926	.960	.945	.959
Saturated Model	1.000		1.000		1.000
Independence Model	.000	.000	.000	.000	.000

The criteria of Comparative Fit Indexes are NFI ≥ 0.95, RFI near to 1, IFI ≥ 0.90, Tucker-Lewis Index (NFI or TLI) greater than or equal (≥) 0.95, CFI ≥ 0.90, CFI varies from 0 to 1, CFI close to 1 indicate a very good fit (A wang, 2012; Shadfar & Malekmohammadi 2013). In Table 5, NFI = .945. Normed fit model varies from 0 to 1, with 1 = perfect fit (Hair, Black, Babin, Anderson, & Tatham, 2010). TLI = .945, Comparative fit index (CFI) = .959, RFI = .926. Though, RFI close to 1 indicates a good fit and IFI = .960 values that are found in the range average conclusive. Tucker-Lewis Index (NFI or TLI) close to 1 illustrate a good fit model. Although, TLI = 0.945 is the cut off value is widely accepted (Cheung & Rensvold, 2002). The entire observed values meet the criterion of Model Fit.

Table 6
Parsimony-Adjusted of the proposed Model

Model	PRATIO	PNFI	PCFI
Default Model	.742	.701	.712
Saturated Model	.000	.000	.000
Independence Model	1.000	.000	.000

Table 6 reveals Parsimony-Adjusted Measures Index (PNFI). Generally, there is no approved and acceptable criterion for a model for the mentioned index (Shadfar & Malekmohammadi, 2013). By random contract, PNFI greater than 0.60 shows a good parsimonious fit. But according to particular authors, parsimonious normed fit index PNFI > 0.50 accepted (Bonifay, Lane, & Reise, 2017). In the case of the study at hand, PNFI is 0.701, which is fit good and acceptable.

Table 7
Model FMIN

Model	FMIN	F0	LO90	HI90
Default Model	.108	.100	.070	.134
Saturated Model	.000	.000	.000	.000
Independence Model	2.510	2.458	2.315	2.606

Table 7 explains the model FMIN. The lowest value of the fit model was estimated using a statistical procedure under the multivariate normal distribution data. The FMIN value near zero is the model fit (Trilok & Amita 2012). The model of the study at hand, FMIN value 0.108, illustrates model goodness–of–fit. This accurate estimated value can also be taken by scrutinizing the confidence intervals value. Here resulted values range from 0.070 to 0.134.

Table 8
RMSEA

Model	RMSEA	LO90	HI90	PCLOSE
Default Model	.045	.038	.052	.862
Independence Model	.193	.187	.199	.000

Table 8 explains the Root Mean Square Error of Approximation (RMSEA), (RMS / RMSE.) It is an inconsistency per degree of freedom. RMSEA is normally reported with its confidence intervals. Ideally, P close should be greater than 0.5 and the corresponding RMSEA less than 0.5. Similarly, the RMSEA value was observed as 0.045, the value of RMSEA ≤. 08 makes the model a “reasonable fit”, however, less than 0.05 is a “close fit” (Xia & Yang, 2019).

Table 9
Akaike's Information Criterion (AIC)

Model	AIC	BCC	BIC	CAIC
Default Model	232.818	233.421	381.937	410.937
Saturated Model	156.000	157.622	557.079	635.079
Independence Model	3194.019	3194.269	3255.724	3267.724

Akaike's information criterion measures and discusses for selecting an optimal model from the alternatives. Researchers conducted a comprehensive evaluation of the path model according to the standard (Claeskens, & Hjort, 2008). Each of the measures above Table 9 allows us to test and examine modeling by providing a clear understanding of the global criteria of the "Proposed Model". All the values reported in Table 9 support model fit.

Table 10
ECVI

Model	ECVI	LO90	HI90	MECVI
Default Model	.180	.156	.220	.185
Saturated Model	.123	.125	.124	.125
Independence Model	2.53	2.384	2.68	2.53

Table 10 illustrates the Expected Cross-validation index (ECVI). It shows additional goodness of fit. Here ECVI = 0.180 compared with the saturated model (ECVI = 0.123) and the independence model (ECVI = 2.53). The conclusion is that the developed model establishes the best fit for the data. This Expected Cross-validation index (ECVI) value can also be taken by observing the CFI i.e. 0.156 to 0.220. These results recommend the model good fit (Schermelleh-Engel, Moosbrugger and Müller 2003). It has also resulted in the fact that the findings of the model support RMSEA too.

Table 11
HOELTER INDEX

Model	HOELTER.05	HOELTER.01
Default Model	480	542
Independence Model	35	39

Table 11 Hoelter index is used to see sample size is accept or reject. Hoelter's N > 200 is adequate (Shadfar & Malekmohammadi, 2013). Here Hoelter's N is greater than 200 i.e. 542 is considered a fit model (Shadfar & Malekmohammadi, 2013). The values of the two N are at the 0.05 and the 0.01 levels, of significance. Sample of the study at hand Hoelter index is adequate as it is in arranging (480-542).

Confirmatory Factor Analysis (CFA) was made to confirm the construct validity of the instrument. The results of having alpha reliability Coefficient 0.788 and were used to decide the appropriateness of the data for factor analyses. It has been confirmed by Büyüköz-türk, (2011) that the value will be accepted as perfect when it comes near 1 and rejected when it is below 0.50. In the same way, Devillis (2003) claims that a construct /

factor of an instrument having α-reliability ≥ 0.50 is reliable. But Steinmetz & Holger 2019) stated that this value should not be less than 0.40. Present study and factor-loading having a value more than 0.50. The trimmed model fit values of the HSSSAES by AMOS are acceptable as seen below.

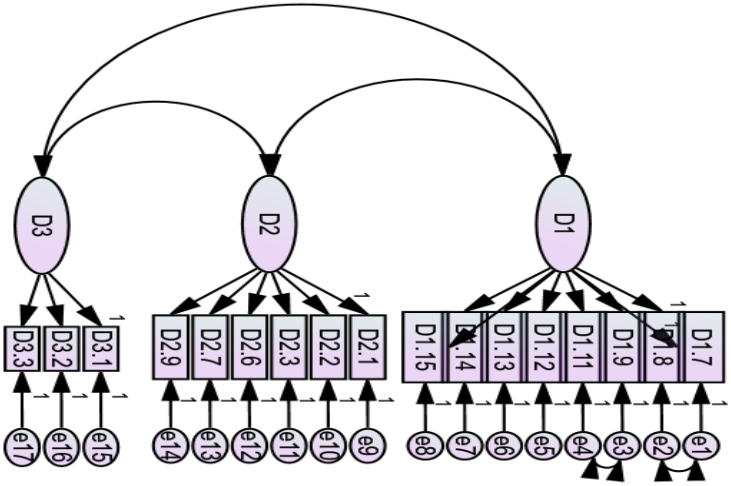

Figure 2: Trimmed Model for Student Engagement

The structural model of three factors of HSSSAES was organized with three sub scales Cognitive engagement (4 statements), Behavioral Engagement (3 statements), and affective Engagement (5 statements). The overall fitness of the three factors structural model to the collected data was measured. To achieve the fit indices of Comparative Fit Index, chi-square ($\chi 2$), and the Standardized Root Mean Square Residual (SRMR) is also calculated.

The structural model has seventeen statements (SD1.7, SD1.8, SD.9, SD1.11, SD1.12, SD1.13, SD1.14, SD1.15, SD2.1, SD2.2, SD2.3, SD2.6, SD2.7, SD2.9, and SD3.1, SD3.2, SD3.3) organized in three (Cognitive, Affective and Behavioral Engagement) sub scales. The overall fit of the three aspects structural model was assessed against alternate fit indices such as chi-square ($\chi 2$), Comparative Fit Index, and the Standardized Root Mean Square Residual (SRMR). A reasonable and comprehensive summary of the overall adjustment measures for the proposed model, and the modified indicated in different tables obtained with small modifications.

Incremental adjustment measures presented an improvement of around 0.1 in each criterion, which together with the modified model improvement about the proposed. The adjustment measures of parsimony presented higher values to the proposed model, which is desirable after the modification, except the PRATIO, which decreases because of the degrees of freedom too. The modified model is straighter forward than the proposed model because 274,599 reduce the AIC.

Appraising the Measurement Model

Evaluating the measurement model applied to confirm partial least squares structural equation modeling. Confirmatory Factor Analyses are the best method to assess the construct validity of the suggested measurement theory.

Table 12
Standardized Regression Weights

Items		Factors No	Estimate
SD1.7	<---	D1	.54
SD1.8	<---	D1	.48
SD1.9	<---	D1	.46
SD1.11	<---	D1	.48
SD1.12	<---	D1	.61
SD1.13	<---	D1	.67
SD1.14	<---	D1	.64
SD1.15	<---	D1	.60
SD2.1	<---	D2	.55
SD2.2	<---	D2	.58
SD2.3	<---	D2	.53
SD2.6	<---	D2	.51
SD2.7	<---	D2	.53
SD2.9	<---	D2	.52
SD3.1	<---	D3	.57
SD3.2	<---	D3	.75
SD3.3	<---	D3	.57

Table 12 reveals Standardized regression weights against each item loadings by using AMOS. This table shows that every one of the statements has a significant loading on the predicted factor. The criterion recommended by Garson, (2011) is near 0.5 and ideally 0.7 or higher. All values are almost near 0.5, and they approximately meet the criterion of Model Fit.

Table 13
Reliability of Higher Secondary School Student Academic Engagement Scales

Factors	Total Items	Mean	St. Deviation	α-reliability co-efficient	Item Numbers
CE	8	2.54	1.16	0.78	SD1.7, SD1.8, SD1.9, SD1.11, SD1.12, SD1.13, SD1.14, SD1.15
BE	6	2.47	1.05	0.71	SD2.1, SD2.2, SD2.3, SD2.6, SD2.7, SD2.9
AE	3	2.42	1.29	0.65	SD3.1, SD3.2, SD3.3
HSSSAES	17	2.60	15.70	0.856	17 items

Internal consistency of the questionnaire was 0.856, which is considered are liable measure. The α - reliability coefficient 0.856 is greater than each of the three factors, show that this instrument is valid and reliable at proper and minimum length (Cho & Chun, 2018). All factors showed adequate reliability. Higher Secondary School Student Academic Engagement Scale (HSSSAES) has sufficient evidence to be a valid and reliable instrument. Eight (8) items were retained for the Cognitive engagement with $\alpha = 0.78$, six (6) items retained for the Behavioral Engagement (BE) with $\alpha = 0.71$, and three (3) items for the Affective Engagement (AE) with $\alpha = 0.65$. Consequently, a questionnaire, comprising 17-item obtained. Piloting results affirmed that the model is valid and reliable with alpha coefficient (.856). The value, worth, quality, and standard of any questionnaire is measured in terms of validity, reliability, and other characteristics.

The results thus provided evidence to use the Higher Secondary School Student Academic Engagement Scale (HSSSAES) to measure the level of academic engagement among higher secondary school students. Seventeen items of HSSSAES were finalized. Its factors Reliability coefficient is reported in Table 13.

An appropriate Length and Face Validity of the Scale

The development and validation of a reliable instrument for measuring different dimensions of academic engagement is the major goal of the study at hand. The appropriate length of the scale increases there liability of the instrument. So someone who develops must balance the number of statements. Suitable numbers of items increase reliability and minimize the burden on the participants (DeVellis, 2017). The survey was conducted to probe the academic engagement of students registered/enrolled in different courses at 9th, 10th, 11th, and 12th grades. After experts' opinions, and statistical analyses, researchers decided to keep shortened instruments that would be critical for their real-world use. Psychologists claimed the prominence of shortened instruments because a large number of students respond easily with minimal effort in a short period (Ary, Jacobs, & Razavieh, 2006). To such an end researchers emphasize reducing the number of statements while still sustaining suitable reliability.

DISCUSSION

The development and validation of a questionnaire measuring higher secondary school student academic engagement is the main objective of the study at hand. The current study provides evidence for the reliability and validity of the Higher Secondary School Student Academic Engagement Scale (HSSSAES). Sample of the study at hand is students enrolled in grades 9th to 12th.

Assessing Higher Secondary School Student Academic Engagement Scale (HSSSAES) fit with sample data (the Modified Model) Preliminary changes, modifications and amendments were incorporated in the Higher Secondary School Student Academic Engagement Scale. The model became fit. The pictorial illustration of the CFA of Higher Secondary School Student Academic Engagement Scale (HSSSAES) was also affirmed that is being represented below. The pictorial representation describes that items of HSSSAES were loaded in three sub-factors called CES, AE, and CE. Eight (8) items were loaded against CE and six (6) items against BE. Similarly three items were loaded against

AE. Moreover, the covariance matrix between the variables was evaluated and found the largest covariance between factors. Hence, covariance was drawn between variables to make the model fit.

Literature has been reviewed and initially, three sub-factors have been decided for measuring the academic engagement of higher secondary school students. Later on, thirty five items (D1 = 15, D2 = 10, D3 = 10) were developed for the questionnaire. First of all, content validity was ensured through subject matter experts. The first six items D1 to D6 from the D1, three items D2.1 to D2.3 from D2, and three items D3.4, D3.6, D3.8 from D3 were excluded. Moreover, the purpose of factor analyses was to ensure the convergent and discriminate validity of the questionnaire. Twenty-three items were analyzed through the statistical procedure. Six items were removed through the Model fit of Confirmatory Factor Analysis (CFA). Consequently obtained a questionnaire, comprising 17–items. The present results were also consistent with the conclusions of the authors of the original version in that the three-factor structure of the Higher Secondary School Student Academic Engagement Scale (HSSSAES) found sufficient support in CFA. Internal consistencies of all the sub-factors and over the entire Questionnaire reflected reasonable results. The internal consistency of the questionnaire was 0.856, which is considered are liable measure (Ref).

All factors showed adequate reliability. Higher Secondary School Student Academic Engagement Scale (HSSSAES) has sufficient evidence to be a valid and reliable instrument.

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APPENDIX A

List of Experts for Instruments Review

S. No.	Name	Designation and Address
1	Dr. Nadia Gillani Ph.D. (Education)	Associate Professor University of Okara
2	Dr. Syed Abdul Waheed Ph.D. (Education)	Associate Professor University of Okara
3	Dr. Khalid Saleem Ph.D. (Education)	Associate Professor University of Okara
4	Dr. Mobeen ul Islam Ph.D. (Education)	Associate Professor University of Gujrat
5	Dr. Seema Arif Ph.D. (Education)	Associate Professor UMT Johar Town Lahore
6	Saima Malik Ph.D. Scholar UMT Johor Town Lahore	Lecturer Govt. Women College, Lahore

Higher Secondary School Student Academic Engagement (HSSSAE)

No	Statements	Level of Satisfaction						
D1.7	I like assigned individual activities	1	2	3	4	5	6	7
D1.8	I measure all parts of my learning process	1	2	3	4	5	6	7
D1.9	I use all of the necessary supplies	1	2	3	4	5	6	7
D1.11	When studying in class, I feel active / energetic	1	2	3	4	5	6	7
D1.12	I like my studies challenges	1	2	3	4	5	6	7
D1.13	In class I like analyzing idea sin –depth in the class	1	2	3	4	5	6	7
D1.14	I think about the future consequences of my learning	1	2	3	4	5	6	7
D1.15	I make plan to reach the desired goal	1	2	3	4	5	6	7
B2.1	I enjoy getting new information	1	2	3	4	5	6	7
D2.2	I like the work which I learning school	1	2	3	4	5	6	7
D2.3	I enjoy learning new knowledge in class	1	2	3	4	5	6	7
D2.6	I feel safe and sound in class	1	2	3	4	5	6	7
D2.7	I willingly help my teacher in developing classroom rules	1	2	3	4	5	6	7
D2.9	My teachers respect my ideas	1	2	3	4	5	6	7
D3.1	I pay attention during class work	1	2	3	4	5	6	7
D3.2	I am a hard worker to do well in class	1	2	3	4	5	6	7
D3.3	I participate in classroom activities	1	2	3	4	5	6	7