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Validating of Survey Instrument in the Perspective of Computer Technology-based Learning

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Abstract

The aim of this study is to fill a gap in current research on the impact of information and communication technology (ICT) on student academic performance by developing a valid and reliable educational acceptance instrument based on the technology acceptance model (TAM) to evaluate the level of students' acceptance and its impact on academic performance. ICT plays an essential component in higher education institutes (HEIs). A critical step in confirming that the results to be achieved are reliable in solving a study's problem is content validation. The goal of this research paper is to describe the usage of the survey instrument Content Validity Index (CVI) to confirm the content of the survey instrument created based on ICT acceptance's impact on students' academic performance. The content validity index was used to determine the usability of a survey questionnaire. Ten field specialists or professionals were selected and used the Expert Panel Rating Chart (EPRC). The opinions of these experts were considered using an item-level CVI (I-CVI) and a scale-level CVI (S-CVI). While certain latent variables and study items were either eliminated or changed, the outcome achieved an acceptable level of validity for the remaining items maintained systematically. In conclusion, the findings of the study discovered that the educational TAM-based acceptance instrument has been valid and reliable to evaluate students' acceptance of ICT and academic performance. In addition, a survey instrument was created by adapting pre-existing scales from earlier TAM instruments as needed. The subsequent tool may be utilised in upcoming studies to examine the acceptance and applications of ICT-based learning.

Keywords: ICT, content validity ratio CVR, Content Validity Index (CVI), instrument validation.

INTRODUCTION

The use and impact of technology are now seen as major factors in many areas of practical life, most notably in education. Currently, students can use ICT as a tool to change the way that learning is done at universities, which will improve student performance. HEIs are implementing ICT-based teaching strategies and providing academic programs with an ICT focus. When a new scale is created, the researchers adhere to rigorous scale development protocols that are anticipated to yield extensive information regarding the reliability and validity of the scale. Information concerning the content validity of the measure is seen as crucial to attract inferences about the scale's superiority, so the criterion-related and construct validity of a new survey instrument are

measured particularly significant. According to the definition of content validity, it is "the defines as an instrument has an suitable model of items for the construct being restrained"(Rodrigues et al., 2017). Additionally, the literature agrees that content validity is basically a concept of judgment and involves two distinct stages; in first a priori stage efforts by the scale developer to improve content validity through careful conceptualization and area analysis prior to item creation, and a posteriori second stage efforts to evaluate the relevance of the scale's basic content through expert assessment (Ã & El-masri, 2005). The second phase of this procedure is the focus of this essay. Over the past two decades, reliable assessment scales for predicting user acceptability of information and communication technologies have been widespread. There are numerous methods for gauging technological acceptance, but many of them are not completely utilized, and it is unclear how they relate to system usage.

Davis created and validated brand-new scales in 1989 for two distinct variables, perceived utility (PU) and perceived ease of use (PEOU), which were thought to be the primary determinants of each user's approval. He discussed the factors used to create scale items that were then reliability and construct validity verified after being pretested for content validity. Basic performance cannot be improved by digital technology if end users are not completely engaged in the process. Understanding why students accept or reject computers is important for improving user acceptability, forecasting, and description(Venkatesh & Davis, 2000). According to Davis, it is possible to predict students' intentions as well as their propensity to adopt new technologies by looking at their actions, subjective norms, perceived utility, and associated variables. According to literature the validity procedure is frequently a list of processes designed for assess the correctness of a measurement tool utilized to record the ideas being evaluated. A measuring device used for instrument development should be able to precisely and methodically measure the contents of the item(Arip et al., 2013). The validity process in research is crucial since it shows whether an instrument can achieve the study's objectives(Kipli & Khairani, 2020b).This is limited and specific drive on a particular cluster of respondents(Shakeel et al., 2023). There are four types of validities: (1) content, (2) construct, (3) face, and (4) criterion-related validity(Masuwai & Shah Saad, 2016).

Since it is a prerequisite for other validities, content validity was given top consideration during instrument construction. (Kipli & Khairani, 2020b). The instrument is enhanced with suggestions given by expert panel and information regarding the area representation and clarity of related items(Yusoff, 2019). In this study used the most popular methods for evaluating the content validity of instrument with EPRC by Content Validity Index (CVI) and Content Validity Ratio (CVR) method. Validity of Content is extent of measuring instrument exactly detentions the construct being evaluated, and it is considered as central support for the accuracy of a measurement tool like a questionnaire in research (Kipli & Khairani, 2020a).Whereas ensuring the accuracy of the content is crucial. As the evidence and best practices, content validation should be carried out systematically. As the literature analysis reveals, that extensive agreement over time that the concepts of domain description, domain relevance, domain representation, and proper test design processes characterize the idea of content validity. Most people would manage that the grey area surrounding this problem is connected to construct validity. The content validity confirmation can be denoted as CVI. By identifying a statistically significant correlation between a measure and a criterion, criterion validity is demonstrated (Rubio et al., 2003).

The "gold standard" for measuring criteria validity is a correlation, which is typically used to assess the statistical relationship. Construct validity was defined by Urbina and his team in 1997 as "level of test may be defined to measure a theoretical construct." Factorial, known groups, convergent, and discriminant (or divergent) validity are three types of concept validity (Rubio et al., 2003). The aim of this research is to evaluate survey instrument and validation of an adapted survey instrument for appraising the content validity in context of impact ICT in academic performance through CVR and CVI methods.

REVIEW OF LITERATURE

We concentrate on a key set of studies on constructs related to technological acceptance in this review section. We examined research that have improved or changed the Technology Acceptance Model for specific technologies, despite the fact that there are a greater range of studies on technology acceptance available in the literature. We present the models as well as the findings of those researches considering this hypothesis and proposed model of ICT acceptance impact on students' academic performance. Developing students' ICT knowledge becomes essential to implementing ICT-based learning. ICT knowledge refers to a person's proficiency with digital technology. Instruments for communication and access to the internet, assemble and incorporate digital materials (Indiwara et al., 2022). With regard to students have access to digital technology for learning, and tools for communication when developing educational materials(Granić & Marangunić, 2019).

In order to ensure the validity of the survey instrument employed in a study and yield a robust result, content validity is unquestionably essential. Chen and colleague concur rules in 2019. Good instrumentation is required by the CVI for monitoring results and enabling efficient making choices. Still, disagreements do exist. on whether testing should take CVI into account for an instrument's reliability and validity (Alasmari, 2017). For this reason, a pilot test was carried out to demonstrate the effectiveness and outcomes demonstrate further that the tool is impartially as agreed upon by the responders. The dependable compared to the test, which revealed a much higher value. prior research suggesting that the components in the polls are quite reliable and useful in research with a similar focus.ICT based learning has a significant impact on education. Because ICT learning can make university feel more like real life, it is essential in the twenty-first century (Sayaf et al., 2022).To be successful in order to use ICT for learning, it is important that ICT knowledge among pupils. Digital technology is used in ICT literacy.Instruments for communication and access to the internet, information creation, organization, integration, and evaluation utilized on a daily basis.

Many approaches of quantifying expert's agreement concerning the content applicability of an survey instrument have been projected. The average rating of expert in relevance items used in predefined in existing literature (Tremblay et al., 2018).several study apprehension interrater agreement have been suggested and utilized mostly in the field of self- perception psychology (Ã & El-masri, 2005).This method consist focus group to indicate items relevancy based CVI scale(Yusoff, 2019). This is an efficient instrument that can aid in the creation of a more effective and organized educational strategy. This philosophical diary method seems to be helpful in enabling students to evaluate both their learning and the efficacy of the teaching strategy (Cooper & Stevens, 2006).The

goal of validation of content is often used in quantitative measure for formative the validity of the contents of any given course material (Martinez-Abad et al., 2016).Content validity is a basic step in augmenting the construct validity of survey questionnaire (Yusoff, 2019). According to research, materials with high content validity are likely to be well-developed and adhere to the best techniques. (Yusoff, 2017). Instrument validity is considered one of significant step to validate items to measure exactly (Straub-Mis, n.d.).Sekaran describes various methods used to ensure instrument validity such as content, convergent, and discriminant validity.

METHODOLOGY

Before the preliminary test, the instrument's content was pre-tested in order to find and address any instrument or design flaws by having professionals answer the questionnaire (Hasim et al., 2022). This enables researchers to eliminate biases and raise the standard of survey-based research by fixing any questionnaire problems before delivering the final edition to respondents. Ten experts and specialists were recruited for this study at various stages to participate in a pre-test of the data collection. The instrument's weaknesses are measured using the content validity index (CVI). Expert contributions to the explanation are essential in this case. the necessary elements' clarification, addition, completion, and modification (Hasim et al., 2022).

In this study, the content validity of the questionnaire was calculated by a panel of experts with doctoral degrees and vast experience in related fields of computer technology, information systems, information technology, organisational behavior, t technology management, and experience with technology adoption. In this situation, specialists play a critical role in defining, elaborating, incorporating, augmenting, and changing the necessary elements. This study was We conducted a content validation of the 11 domains, and 50 items were sent by e-mail and postal service to 10 related field experts and professionals, one from Malaysia and the other from Pakistan, for content evaluation.

Each factor was defined clearly, and all items were listed systematically. The degree of each item's relevancy to be measured was asked to be rated by the experts. E.g., the responses were measured using a four-point Likert scale given below Fig. 1. There are six stages in the content validation procedure.:

- Formulating content validation proforma
- Choosing a panel of experts
- Conduct Content Validation
- Piloting content validation
- Revising domain area and items
- Tagging score on each item
- Calculation CVI

Stage 1: Formulating content validation proforma

To ensure that the expert panel will have a clear understanding of the form's purpose, the primary step in content validation is to generate a proforma.

Table 1.
Represents content validity proforma

Content Validity Form

Dear Expert,

I am a Ph.D. scholar and am conducting research on "Information and Communication Technology (ICT) Acceptance Impact on Students' Academic Performance: Higher Education Institutes (HEIs) in Sindh, Pakistan." This survey contains 11 domains or constructs and 50 items or statements related to the research title. This is to request your professional opinion on the degree of each item's relevance and clarity to the measured domains. Please follow the instructions below when using the rating scales.

Degree of Relevance:

- The item is not relevant to the measured domain.
- The item is somewhat relevant to the measured domain.
- The item is quite relevant to the measured domain.
- The item is highly relevant to the measured domain.

Domain: ICT acceptance impact on students' academic performance **Definition: Student perception usage ICT enhances their performances**							
H 1		**(A) Behavioral Intention (BI) (TAM)** (Venkatesh & Davis, 2000)					
		Statement	**Relevance**				**Remarks**
1	BI1	I believe ICT improve the quality of education in the universities.	1	2	3	4	
2	BI2	I would use an ICT based learning system for accessing and sharing materials in the future with peers.	1	2	3	4	
3	BI3	I would keep using the content and material of ICT based learning for my academic activities.	1	2	3	4	
4	BI4	I would continue to use ICT based learning frequently for learning new concepts in the future.	1	2	3	4	
5	BI5	I would recommend others to use the ICT based learning.	1	2	3	4	

Figure1.
Representation of content validation proforma, items and domain details

Formulating content validation proforma

To ensure that the expert panel will have a clear understanding of the form's purpose, the first step in content validation is to create the form.

Choosing panel of experts

The choice of a person to review and analyze a questionnaire or other assessment instrument is typically made based on that person's expertise in the relevant topic. It is possible that the minimum and maximum expert numbers for content validation are two and at least six and ten, respectively.

Piloting Content Validation

Face-to-face interactions and email are all viable methods for doing content validation. Both methods were used in this investigation. Prioritizing additional factors should include consideration of cost, time, and response rate. The expense and time of doing a face-to-face approach may be the most challenging due to the challenge of assembling all professionals in one location, but the response rate will be at its highest.

Number of experts	Acceptable CVI values	Source of recommendation
Two experts	At least 0.80	Davis (1992)
Three to five experts	Should be 1	Polit & Beck (2006), Polit et al., (2007)
At least six experts	At least 0.83	Polit & Beck (2006), Polit et al., (2007)
Six to eight experts	At least 0.83	Lynn (1986)
At least nine experts	At least 0.78	Lynn (1986)

Figure 2.
Number of experts and cut of score
Sources: Beck (2006), Polit et al., (2007)

Revising domain area and items

The content validation form, as shown in Figure 2, explicitly explains the domain's scope and the components that make up the domain to the experts. The experts are required to critically study the domain and its elements prior to evaluating each item. Experts are asked to provide written or verbal comment to strengthen the items' relevance to the intended topic. To enhance the domain and its goods, every feedback is taken into account.

Tagging score on each item

After examining the related domain and content of items, the experts are requested to provide scores on each item discretely using the appropriate scale; figure 1 and figure 2. The experts are required to respond the scholars after completion each items accordingly.

Calculating CVI

The Scale-based and item-based CVI are the two forms of CVI. The percentage of items marked by expert that obtain a relevance score of three or higher from all experts (S-CVI/UA) and the average of the I-CVI scores for all items on the scale (S-CVI/Ave) are the two ways to compute S-CVI; Figure 2 shows the relevant item scale used by ten experts.

Table 2.
The Description and formula

The CVI indices	Description	Formula
I-CVI (item-level content validity index)	The proportion of content experts giving item a relevance rating of 3 or 4	I-CVI = (agreed item)/ (number of expert)
S-CVI/Ave (scale-level content validity index based on the average method)	The average of the I-CVI scores for all items on the scale or the average of proportion relevance judged by all experts. The proportion relevant is the average of relevance rating by individual expert.	S-CVI/Ave = (sum of I-CVI scores)/(number of item) S-CVI/Ave = (sum of proportion relevance rating)/ (number of expert)
S-CVI/UA (scale-level content validity index based on the universal agreement method)	The proportion of items on the scale that achieve a relevance scale of 3 or 4 by all experts. Universal agreement (UA) score is given as 1 when the item achieved 100% experts in agreement; otherwise the UA score is given as 0.	S-CVI/UA = (sum of UA scores)/(number of item)

Sources: Lynn (1986), Polit & Beck (2006), Polit et al., (2007)

RESULTS AND DISCUSSION

An Analysis of CVI, the Scholars organized for ten subject experts with substantial knowledge in their domain and having professional knowledge in the field to partake in this study. One of them selected Malaysia and other from Universities of Pakistan. All selected they have more than 10 years of experience in research in core area. The content form distributed face to face and by e-mails. Profiles of experts is shown in the table 3

Table 3.
The Details of expert

Experts (E)	Research experience	Current position	Area of expertise	Organization
E1	>30 years	Professor & Head of Department in Malaysia	Information System (Technology Management)	International Islamic University Malaysia
E2	>26 years	Professor & Head of Department	Information System (Technology Management)	Sindh Madressatul Islam University (SMIU)
E3	>25 years	Professor & former chairman	Organizational Behavior	University of Sindh
E4	>14 years	Associate Professor	Information System (Social Influence of Technology)	University of Sindh
E5	>14 years	Associate Professor	Management Science	University of Sindh
E6	>13 years	Associate Professor	Computer Science (Web Based Learning)	Sindh Agriculture University Tandojam
E7	>12 years	Assistant Professor	Computer Science	University of Sindh
E8	>12 years	Assistant Professor	Information System	University of Sindh

E9	>12 years	Assistant Professor	Computer Science	University of Sindh
E10	>12 years	Assistant Professor	Information Technology Management	University of Sindh

CVI Analysis

This CVI analysis in table 4 shown score given by expert and calculated by formula given in table 2. accordingly.

Table 4.
Rating given by experts

Constructs	Items	Expert consent (√)										No of expert consent	CVR	I-CVI	UA
		E1	E2	E3	E4	E5	E6	E7	E8	E9	E10				
Behavioral Intention															
BI1	I believe ICT improve the quality of education in the universities.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
BI2	I would use an ICT tools for learning system, accessing and sharing materials in the future with friends.	√	√	√	X	√	√	√	√	√	√	9	0.8	0.9	0
BI3	I would keep using an ICT for content and material for my academic activities.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
BI4	I would continue to use ICT skills frequently for learning new concepts in the future.	√	√	√	√	√	√	X	√	√	√	9	0.8	0.9	0

BI5	I would recommend others to use the ICT for learning.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
Perceived Usefulness (PU)															
PU1	I believe an ICT improve my academic learning performance.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
PU2	I believe an ICT improves my skills and efficiency.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
PU3	I believe an ICT enhances my learning effectiveness.	√	√	√	√	√	√	√	√	√	**X**	9	0.8	0.9	0
PU4	I believe an ICT promotes my learning productivity.	√	√	√	√	√	√	√	**X**	√	√	9	0.8	0.9	0
Perceived Ease of Use (PEOU)															
PEOU1	ICT is easy to use for me.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
PEOU2	ICT easily share learning materials.	√	√	√	√	√	**X**	√	√	√	√	9	0.8	0.9	0
PEOU3	ICT eases a lot of mental pressure of the availability of materials.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
PEOU4	ICT enhances the clarity and understanding.	√	√	√	√	√	√	√	√	√	√	9	0.8	0.9	0
Interest															
I1	The use of ICT skills for learning enhances my awareness.	√	√	√	√	√	√	√	√	√	√	10	1	1	1

I2	The use of ICT skills for learning is entertaining.	√	√	√	√	√	√	√	**X**	√	√	9	0.8	0.9	0
I3	The use of ICT skills for learning arouses my curiosity.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
I4	The usage of ICT tools is interested.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
ICT Self-efficacy															
ISE1	If I have previously heard of an ICT services, I will use it.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
ISE2	If my friends introduce me to an ICT services, I will use it.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
ISE3	I think, I can use an ICT services if somebody help me how to operate it.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
ISE4	I think, I can use ICT services, if already used related technology before this one.	**X**	√	√	√	√	√	√	√	√	√	9	0.8	0.9	0
ISE5	I feel comfortable using ICT to enhance my creativity.	√	**X**	√	√	√	√	√	√	√	√	9	0.8	0.9	0
Economic cost															
EC1	The cost of using ICT products for studies is higher than other products.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
EC2	The ICT products for my studies are costly for me.	√	√	√	√	√	**X**	√	√	√	√	9	0.8	0.9	0
EC3	Using ICT products for Studies is a cost burden to me.	√	√	√	√	√	√	**X**	√	√	√	9	0.8	0.9	0
Satisfaction															

S1	The interaction of ICT-based learning meets my standards.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
S2	I am entirely satisfied with the features and material of ICT systems.	√	√	√	√	√	√	√	**X**	√	√	9	0.8	0.9	0
S3	I am fairly satisfied with ICT systems.	√	√	**X**	√	√	√	√	√	√	√	9	0.8	0.9	0
Facilitating conditions															
FC1	My living environment supports me to use ICT systems for my learning objectives.	√	√	√	√	√	**X**	√	√	√	√	9	0.8	0.9	0
FC2	My academic work are compatible with ICT systems	√	√	√	√	√	√	√	√	√	√	10	1	1	1
FC3	Technical staff is available for assistance while having difficulty in using ICT systems.	√	√	√	√	√	√	√	√	√	**X**	9	0.8	0.9	0
FC4	My university has implemented ICT based services for all sections.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
Social Influence															
SI1	I should use ICT systems, according to those who have influence over my behavior.	√	√	√	√	√	√	√	√	√	√	10	1	1	1

SI2	My working environment influences me to use ICT systems.	√	√	√	√	√	√	**X**	√	√	√	9	0.8	0.9	0
SI3	ICT awareness in my social circle influences me to use ICT systems	√	√	√	**X**	√	√	√	√	√	√	9	0.8	0.9	0
SI4	Technology awareness among friends encourages using ICT systems in my learning.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
Performance Expectancy															
PE1	Using ICT- based learning would improve my academic performance.	√	√	√	√	√	√	√	√	√	√	10	1	1	1
PE2	Using ICT- based learning I can achieve tasks more quickly.	√	√	√	√	√	√	**X**	√	√	√	9	0.8	0.9	0
PE3	Using ICT-based learning will improve my chances of gaining knowledge.	√	√	√	√	√	√	**X**	√	√	√	9	0.8	0.9	0
PE4	The utilization of ICT in universities has improved students' overall performance.	√	√	√	√	√	√	√	√	√	**X**	9	0.8	0.9	0
												35.8	**370**	**37**	**16**
												90%		**93 %**	**40 %**

Total Relevant items = 40 Proportion Relevant (S-CVI/UA) = 16/40 =0.40 & S-CVI/Ave= (0.925)

I-CVI = Item level content validity index. S CVI/UA = Scale-level content validity index, universal agreement calculation technique.

Table 5 displays the CVI analysis of the content of items that have received a low rating.

Based on the information gathered, the researcher calculated the I-CVI.Using item 1 as an example, you may write, "I think ICT improve the quality of education in the universities." The calculation was 10/10 = 1.00 (approved) because all ten experts agreed

on the issues. Similarly, only two or three experts out of ten felt that items 41 to 50 should be included in the questionnaire. Thus, 2/10 =.60 (an undesirable result) was the calculation. With 40 items scoring I-CVI.80 or above and items scoring.60, the overall result is good. With a score of less than 0.7, items 41 through 50 had the least agreement among the experts. The S-CVI average obtained by division of related percentage (items that score greater than (0.7)) by the total number of I-CVI.

Table 5.
Items low rating by expert.

Proportion Relevance	E 1	E2	E3	E4	E5	E6	E7	E8	E9	E10	CVR	No of expert agreement	I-CVI-I	U A
Item 42		√								√	-0.6	2	0.2	0
Items 43				√				√			-0.6	2	0.2	0
Items 44	√										-0.8	1	0.1	0
Items 45		√						√			-0.6	2	0.2	0
Items 46	√										-0.8	1	0.1	0
Items 47				√							-0.8	1	0.1	0
Items 48		√						√	√		-0.4	3	0.3	0
Items 49	√								√		-0.6	2	0.2	0
Items 50	√			√						√	-0.4	3	0.3	0

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In this way similar approach applied in all items, some content of items was amended based on expert opinion hence, low agreement items and latent variable omitted in the reason was same purpose and less familiarity.

CONCLUSIONS

It is commonly known that researchers all over the world frequently use CVI as a technique to develop and verify new tools for their research. However, this paper first tries to recognise CVI as a preferred instrument validation application in educational studies, particularly in the area of ICT adoption evaluation. Secondly, this study demonstrates that the CVI is an effective method for calculating the validity of the content quantitatively for an adapted instrument, and in the last stage, it presents that the CVI provides a strong manifestation of the validity and reliability of research instruments. Making selections that are effective will ultimately be aided by a reliable research tool. Therefore, CVI is seen as one of the most promising ways for instrument development in educational studies and as a useful method for determining the content validity of a new learning module (s-CVI/UA = 0.80, s-CVI/Ave = 0.925). Students were able to learn the proper method of research criticism thanks to their familiarity with content validity studies

RECOMMENDATION AND IMPLICATIONS

The content experts were requested to categorise the items in the EPRS as acceptable, needing change, or unacceptable before they were delivered. This was the initial stage

of the validation process for the study's instrument. In addition to objectively assessing the level of agreements, the EPRC has shown the expert ability to comment and make proposals. One of the questionnaire's recommendations is carried out. This is a significant response since, without the distribution of the EPRC, the project wouldn't advance. The instrument was able to be tweaked properly thanks to this feedback. The researchers also provided sample data demonstrating the value of CVI in validating instruments that have been altered to better fit the context of the planned study. For this study, which will be used at several universities in Sindh, we adapted the survey instrument. Researchers in educational studies ought to think about utilising CVI in the creation, validation, and assessment of testing their tools to achieve an improved outcome to aid in the decision-making process, which might be advantageous for everyone involved.

DECLARATIONS

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