

CONSTRUCT VALIDITY ANALYSIS OF STELLAR EVOLUTION CONCEPT MASTERY TEST TO REDUCE MISCONCEPTIONS

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Keyword

Validity, Differentiation, Instrument, Stellar Evolution, Multiple Choice, Physics, Physics Education

Abstract

This study aims to determine the validity of an instrument that is able to measure misconceptions and accommodate multiple intelligences. The development of the Star Evolution Concept Mastery Test instrument is an instrument containing fifteen multiple choice questions based on stellar evolution material from the beginning of the birth of a star to the death of a star. This research uses the Research & Development (R&D) method. To determine the validity of this instrument, expert judgment was carried out by two experts in their fields. Expert judgment was conducted to determine construct validity. From the results of the analysis, it was found that almost all questions were accepted and could be used after revision according to the notes from the experts. So that the instrument is considered feasible and declared valid, which means that this instrument can measure misconceptions and can be used.

INTRODUCTION

The universe has immense dimensions. The universe, as a measure of the limits of reason and technology, reflects human life in the past, present, and future. Human social life is represented in the movement of heavenly bodies, such as the desire to congregate, partner, and even birth and death. Since ancient times, humans have incorporated knowledge of the universe into their cultural lives. Celestial bodies like the sun, moon, and stars have traditionally served as emblems of their beliefs. Humans can determine the mass, temperature, and chemical composition of stars by studying their phenomena. We can also identify the age of stars, whether they are newborns, young, old, or deceased. Observing different stars allows astronomers to gain a comprehensive understanding of their evolution.

Natural science has several intriguing fields to explore, one of which is earth and space, which is covered in junior high, high school, and college courses. Earth and Space material is deemed intriguing since it contains information on everything that happens in the universe and on Earth, from the origin of the universe's formation to future natural phenomena. As humans, we can understand knowledge about the earth and space in a variety of ways because we are born with various types of uniqueness, and each individual brings their own idiosyncrasies. Differentiated learning refers to the process of meeting unique learning demands.

Differentiation in this example relates to many intelligences, a hypothesis that attempts to comprehend each individual's intelligence through a variety of lenses. Multiple intelligence encompasses eight distinct types of intelligence: visual spatial intelligence, gestural intelligence, musical intelligence, verbal/linguistic intelligence, interpersonal intelligence, intrapersonal intelligence, and naturalistic intelligence. Each person can have multiple types of intelligence that assist them grasp information.

The learning process in formal education includes not just the provision of material, but also tools for determining the extent of students' comprehension. Instruments used to identify

misconceptions in pupils that would be ineffective if examined solely through objective assessments. Knowing the validity of an instrument is an important component of creating one. The validity of an instrument refers to how far the instrument's measurement can measure the properties that should be measured.

METHOD

The research methodology used is Research and Development (R&D). The R&D process is a research technique that uses steps to create specialized items. Stellar Evolution Concept Mastery Test will be evaluated for its validity. The development of the instrument presented in this study is based on Thiagarajan's 4D model. According to Thiagarajan, the stages of a 4D model are defining, designing, developing, and disseminating. However, the researcher only completed three stages: definition, design, and development. Due to time constraints, the dissemination stage must still be carried out. The validation was carried out by two qualified and skilled instructors.

RESULTS

In this material, students are expected to understand the notion of stellar evolution in order to eliminate misconceptions, hence an instrument that can measure misconceptions is required, which can then be employed together through differentiated learning. The aim of designing the Star Evolution Concept Mastery Test instrument is to encourage students to actively participate in learning activities such as asking questions, expressing opinions, answering questions, observing, conducting investigations, analyzing information, and applying concepts and principles to stellar evolution material. As a result, the instrument includes questions to help clear any misconceptions concerning stellar development.

The content of each page is intended to provide an outline of the instrument that will be built. This is done to facilitate the instrument's design. In the design stage, the instrument developed can adhere to the content structure established during the prior definition step. The instrument's material consists of multiple-choice questions ranging from the beginning of stars' lives to their deaths.

The next step is validation, which is carried out by experts validators. The validation process is used to determine the practicality of the instrument developed. Validators will offer ideas and comments of the instruments created. The validation process is carried out by two competent and expert professors. Expert judgment is used to determine construct validity.

Table 1. Star Evolution Concept Mastery Test Grid

Material	No	Validator		Conclusion	Notes
		1	2		
Star formation process	1.	AR	AR	UR	Giant clouds of gas and dust undergo gravitational collapse due to external and internal factors and then undergo condensation and fragmentation
Hydrogen nuclear fusion	2.	AR	AR	UR	The collision process that occurs at the center of these stars occurs at very high temperatures (tens of millions of Kelvin), making the nuclei of the colliding atoms come together (fusion) to produce heavier atomic nuclei.
Energy in stars	3.	AR	AR	UR	stars perform nuclear fusion at their centers as long as there is "raw material" to convert into energy through nuclear reactions

Star-forming materials	4.	A	A	U	-
Where stars form	5.	A	A	U	-
Length of a star's formation	6.	AR	AR	UR	Chemical reactions are not the same as nuclear reactions
Star lifetime	7.	U	U	U	
Lifespan relationship with star size	8.	AR	AR	UR	The greater the mass of the star, the greater the energy it produces per second
Relationship of material mass to critical mass	9.	AR	AR	UR	Does the word "solid" here refer to one of the phases of the substance or is it to describe the word "compressed"?
Star-forming factors	10.	AR	A	UR	Does size refer to mass, radius, or other physical quantities?
Time and number of stars	11.	A	A	U	-
End of life sun	12.	AR	AR	UR	The evolutionary paths that stars take differ from one another, depending on the initial mass they had when they became main sequence stars.
Red giant stage	13.	A	A	U	-
Cause of star death	14.	AR	AR	UR	When a star runs out of hydrogen in its center, it does not necessarily die. The star will continue to carry out nuclear reactions by converting the hydrogen in the skin of the center into helium, until the temperature in the center is high enough to convert helium into carbon.
Supernova	15.	AR	AR	UR	It is precisely through these supernovae that the suns in interstellar space, which form the next generation of stars, are fouled by the presence of heavy elements produced by nuclear reactions at the centers of these massive stars.

Decription:

A = Accepted

AR = Accepted after revision

U = Used

UR = Used after revision

Based on the validation results of the instrument that has been developed, revisions are made according to the notes given by the validator to make it easier for students to understand. Therefore, it can be concluded that the content of the instrument is good and can be disseminated.

DISCUSSION

Construct validity is a crucial part of test development because it ensures that the measuring instrument accurately assesses the target idea, which in this case is mastery of the concept of stellar evolution. To investigate construct validity, the test results were examined in terms of the theories underlying the idea of star evolution, as well as how these theories are represented in the testing instrument.

CONCLUSION

Based on these findings, we may conclude that the instrument designed for the Star Evolution Concept Mastery Test is usable. This demonstrates that the instrument development is 'feasible' and can be extensively implemented.

Based on the data analysis, the findings indicate that the items in this test are strongly related to crucial aspects in stellar evolution theory. For example, items that assess understanding of the stages of stellar evolution from nebula to neutron star or black hole have a strong link with the basic ideas established in the literature. This shows that the instrument can capture the essence of the concept of stellar evolution as a whole.

Thus, it can be concluded that, in general, this stellar evolution concept mastery test has good construct validity, albeit certain areas might be improved. These modifications are critical to ensuring that the test not only effectively measures the notion of stellar development, but also serves as a valid evaluation tool in astronomical research and education.

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