

Package ‘spheredata’

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Title Students' Performance Dataset in Physics Education Research
(SPHERE)

Version 0.1.1

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Description A multidimensional dataset of students' performance assessment in high school physics. The SPHERE dataset was collected from 497 students in four public high schools specifically measuring their conceptual understanding, scientific ability, and attitude toward physics [see Santoso et al. (2024) <doi:10.17632/88d7m2fv7p.1>]. The data collection was conducted using some research based assessments established by the physics education research community. They include the Force Concept Inventory, the Force and Motion Conceptual Evaluation, the Rotational and Rolling Motion Conceptual Survey, the Fluid Mechanics Concept Inventory, the Mechanical Waves Conceptual Survey, the Thermal Concept Evaluation, the Survey of Thermodynamic Processes and First and Second Laws, the Scientific Abilities Assessment Rubrics, and the Colorado Learning Attitudes about Science Survey. Students' attributes related to gender, age, socioeconomic status, domicile, literacy, physics identity, and test results administered using teachers' developed items are also reported in this dataset.

BugReports <https://github.com/santosoph/spheredata/issues>

URL <https://github.com/santosoph/spheredata>

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binary	<i>Compute the students' score</i>
--------	------------------------------------

Description

Compute the students' score as binary/ dichotomous data

Usage

```
binary(raw, key)
```

Arguments

raw	a dataframe of raw response data
key	a dataframe of answer key

Value

a dataframe of dichotomous format of students' response data

Examples

```
# Import the FCI score and key data
library(spheredata)
data("FCI")
data("FCIkey")

# Processing the Force Concept Inventory (FCI) data as dichotomous
binary(FCI, FCIkey)
```

CLASS

Colorado Learning Attitudes about Science Survey (CLASS) dataset

Description

The CLASS originally includes 42 attitudinal items measuring students' attitude toward physics learning within five categories of Likert scale ranging from strongly disagree (1) to strongly agree (5). In this package, thirty-six CLASS items have been preprocessed based on the scoring rule as suggested by Adams et al. (2006).

Usage

```
data(CLASS)
```

Format

A data frame with 497 observations on the following 36 CLASS items (after preprocessed using the scoring rule).

CLASS1 A significant problem in learning physics is being able to memorize all the information I need to know.

CLASS2 When I am solving a physics problem, I try to decide what would be a reasonable value for the answer.

CLASS3 I think about the physics I experience in everyday life.

CLASS5 After I study a topic in physics and feel that I understand it, I have difficulty solving problems on the same topic.

CLASS6 Knowledge in physics consists of many disconnected topics.

CLASS8 When I solve a physics problem, I locate an equation that uses the variables given in the problem and plug in the values.

CLASS10 There is usually only one correct approach to solving a physics problem.

CLASS11 I am not satisfied until I understand why something works the way it does.

CLASS12 I cannot learn physics if the teacher does not explain things well in class.

CLASS13 I do not expect physics equations to help my understanding of the ideas; they are just for doing calculations.

CLASS14 I study physics to learn knowledge that will be useful in my life outside of school.

- CLASS15 If I get stuck on a physics problem my first try, I usually try to figure out a different way that works.
- CLASS16 Nearly everyone is capable of understanding physics if they work at it.
- CLASS17 Understanding physics basically means being able to recall something you've read or been shown.
- CLASS18 There could be two different correct values to a physics problem if I use two different approaches.
- CLASS19 To understand physics, I discuss it with friends and other students.
- CLASS20 I do not spend more than five minutes stuck on a physics problem before giving up or seeking help from someone else.
- CLASS21 If I don't remember a particular equation needed to solve a problem on an exam, there's nothing much I can do (legally!) to come up with it.
- CLASS22 If I want to apply a method used for solving one physics problem to another problem, the problems must involve very similar situations.
- CLASS23 In doing a physics problem, if my calculation gives a very different from what I'd expect, I'd trust the calculation rather than going back through the problem.
- CLASS24 In physics, it is important for me to make sense out of formulas before I can use them correctly.
- CLASS25 I enjoy solving physics problems.
- CLASS26 In physics, mathematical formulas express meaningful relationships among measurable quantities.
- CLASS27 It is important for the government to approve new scientific ideas before they can be widely accepted.
- CLASS28 Learning physics changes my ideas about how the world works.
- CLASS29 To learn physics, I only need to memorize solutions to sample problems.
- CLASS30 Reasoning skills used to understand physics can be helpful to me in my everyday life.
- CLASS32 Spending a lot of time understanding where formulas come from is a waste of time.
- CLASS34 I can usually figure out a way to solve physics problems.
- CLASS35 The subject of physics has little relation to what I experience in the real world
- CLASS36 There are times I solve a physics problem more than one way to help my understanding.
- CLASS37 To understand physics, I sometimes think about my personal experiences and relate them to the topic being analyzed.
- CLASS38 It is possible to explain physics ideas without mathematical formulas.
- CLASS39 When I solve a physics problem, I explicitly think about which physics ideas apply to the problem.
- CLASS40 If I get stuck on a physics problem, there is no chance I'll figure it out on my own.
- CLASS42 When studying physics, I relate the important information to what I already know rather than just memorizing it the way it is presented.

Source

Santos, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1

References

Adams, W. K. et al. New instrument for measuring student beliefs about physics and learning physics: The Colorado Learning Attitudes about Science Survey. *Physical Review Special Topics - Physics Education Research* 2, 010101 (2006).

Examples

```
data(CLASS)
```

```
demographic
```

```
Students' demographic of the SPHERE dataset
```

Description

This dataset is used to describe the students' contexts participating in the study.

Usage

```
data(demographic)
```

Format

A data frame with 497 observations on the following 8 demographic variables.

STUDID Students' identity. The first letter denotes the school code. The second one coins the students' cohort within schools. Three last numbers for their alphabetical orders.

SCH School sample participated in the study.

COH Students' class within schools. 1 = Group A, 2 = Group B, 3 = Group C, 4 = Group D

GDR Students' gender. 1 = Male, 2 = Female

AGE Students' age. 1 = 13-14 years, 2 = 15-16 years, 3 = 17-18 years, 4 = 19-20 years

FATHOCC Father's occupation. 1 = Entrepreneur, 2 = Farmer, 3 = Armed force, 4 = Private employee, 5 = Educator, 6 = Medicine, 7 = Civil servant, 8 = Unemployed, 9 = Others

MOTHOCC Mother's occupation. 1 = Entrepreneur, 2 = Farmer, 3 = Armed force, 4 = Private employee, 5 = Educator, 6 = Medicine, 7 = Civil servant, 8 = Unemployed, 9 = Others

FATHEDU Father's education. 1 = Graduate, 2 = Undergraduate, 3 = Vocational, 4 = High school, 5 = Junior high school, 6 = Elementary, 7 = Unfinished education, 8 = Out of formal education

MOTHEDEU Mother's education. 1 = Graduate, 2 = Undergraduate, 3 = Vocational, 4 = High school, 5 = Junior high school, 6 = Elementary, 7 = Unfinished education, 8 = Out of formal education

FATHINC Father's monthly income. 1 = More than IDR10.000.000, 2 = IDR9.000.000-IDR10.000.000, 3 = IDR8.000.000-IDR9.000.000, 4 = IDR7.000.000-IDR8.000.000, 5 = IDR6.000.000-IDR7.000.000, 6 = IDR5.000.000-IDR6.000.000, 7 = IDR4.000.000-IDR5.000.000, 8 = IDR3.000.000-IDR4.000.000, 9 = IDR2.000.000-IDR3.000.000, 10 = IDR1.000.000-IDR2.000.000, 11 = Less than IDR1.000.000, 12 = No income

MOTHINC Mother's monthly income. 1 = More than IDR10.000.000, 2 = IDR9.000.000-IDR10.000.000, 3 = IDR8.000.000-IDR9.000.000, 4 = IDR7.000.000-IDR8.000.000, 5 = IDR6.000.000-IDR7.000.000, 6 = IDR5.000.000-IDR6.000.000, 7 = IDR4.000.000-IDR5.000.000, 8 = IDR3.000.000-IDR4.000.000, 9 = IDR2.000.000-IDR3.000.000, 10 = IDR1.000.000-IDR2.000.000, 11 = Less than IDR1.000.000, 12 = No income

SIBL Number of siblings belonged to the student. Zero means student as an only child.

DOM Student's domicile from the school location. 1 = Inside the zoning area of the school. 2 = Outside the zoning area of the school.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, *V1*, (2024). doi: 10.17632/88d7m2fv7p.1

Examples

```
data(demographic)
```

FCI

The Force Concept Inventory (FCI) dataset

Description

The focus of the FCI is intended to measure students' conceptual understanding of Newtonian mechanics. It comprises of 30 multiple-choice items with five possible responses (a key and four distractors).

Usage

```
data(FCI)
```

Format

A data frame with 497 observations on the following 30 FCI multiple choice items.

FCI1 A character of the FCI item number 1.

FCI2 A character of the FCI item number 2.

FCI3 A character of the FCI item number 3.

FCI4 A character of the FCI item number 4.

FCI5 A character of the FCI item number 5.

- FCI6 A character of the FCI item number 6.
- FCI7 A character of the FCI item number 7.
- FCI8 A character of the FCI item number 8.
- FCI9 A character of the FCI item number 9.
- FCI10 A character of the FCI item number 10.
- FCI11 A character of the FCI item number 11.
- FCI12 A character of the FCI item number 12.
- FCI13 A character of the FCI item number 13.
- FCI14 A character of the FCI item number 14.
- FCI15 A character of the FCI item number 15.
- FCI16 A character of the FCI item number 16.
- FCI17 A character of the FCI item number 17.
- FCI18 A character of the FCI item number 18.
- FCI19 A character of the FCI item number 19.
- FCI20 A character of the FCI item number 20.
- FCI21 A character of the FCI item number 21.
- FCI22 A character of the FCI item number 22.
- FCI23 A character of the FCI item number 23.
- FCI24 A character of the FCI item number 24.
- FCI25 A character of the FCI item number 25.
- FCI26 A character of the FCI item number 26.
- FCI27 A character of the FCI item number 27.
- FCI28 A character of the FCI item number 28.
- FCI29 A character of the FCI item number 29.
- FCI30 A character of the FCI item number 30.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Hestenes, D., Wells, M. & Swackhamer, G. Force concept inventory. *Phys Teach* 30, 141–158 (1992).

Examples

```
data(FCI)
```

FCIkey

The Force Concept Inventory (FCI) key dataset

Description

The answers key to analyze the students' obtained score on the FCI.

Usage

data(FCIkey)

Format

A data frame of a key record on the following 30 FCI items.

- FCI1 A key of the FCI item number 1.
- FCI2 A key of the FCI item number 2.
- FCI3 A key of the FCI item number 3.
- FCI4 A key of the FCI item number 4.
- FCI5 A key of the FCI item number 5.
- FCI6 A key of the FCI item number 6.
- FCI7 A key of the FCI item number 7.
- FCI8 A key of the FCI item number 8.
- FCI9 A key of the FCI item number 9.
- FCI10 A key of the FCI item number 10.
- FCI11 A key of the FCI item number 11.
- FCI12 A key of the FCI item number 12.
- FCI13 A key of the FCI item number 13.
- FCI14 A key of the FCI item number 14.
- FCI15 A key of the FCI item number 15.
- FCI16 A key of the FCI item number 16.
- FCI17 A key of the FCI item number 17.
- FCI18 A key of the FCI item number 18.
- FCI19 A key of the FCI item number 19.
- FCI20 A key of the FCI item number 20.
- FCI21 A key of the FCI item number 21.
- FCI22 A key of the FCI item number 22.
- FCI23 A key of the FCI item number 23.
- FCI24 A key of the FCI item number 24.
- FCI25 A key of the FCI item number 25.

- FCI26 A key of the FCI item number 26.
- FCI27 A key of the FCI item number 27.
- FCI28 A key of the FCI item number 28.
- FCI29 A key of the FCI item number 29.
- FCI30 A key of the FCI item number 30.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Hestenes, D., Wells, M. & Swackhamer, G. Force concept inventory. *Phys Teach* 30, 141–158 (1992).

Examples

```
data(FCIkey)
```

FMCE

The Force and Motion Conceptual Evaluation (FMCE) dataset

Description

Similar with the FCI, the goal of the FMCE is also intended to measure students' conceptual understanding of Newtonian mechanics. It comprises of 47 multiple-choice items.

Usage

```
data(FMCE)
```

Format

A data frame with 497 observations on the following 47 FMCE multiple choice items.

- FMCE1 A character of the FMCE item number 1.
- FMCE2 A character of the FMCE item number 2.
- FMCE3 A character of the FMCE item number 3.
- FMCE4 A character of the FMCE item number 4.
- FMCE5 A character of the FMCE item number 5.
- FMCE6 A character of the FMCE item number 6.
- FMCE7 A character of the FMCE item number 7.
- FMCE8 A character of the FMCE item number 8.

FMCE9 A character of the FMCE item number 9.
FMCE10 A character of the FMCE item number 10.
FMCE11 A character of the FMCE item number 11.
FMCE12 A character of the FMCE item number 12.
FMCE13 A character of the FMCE item number 13.
FMCE14 A character of the FMCE item number 14.
FMCE15 A character of the FMCE item number 15.
FMCE16 A character of the FMCE item number 16.
FMCE17 A character of the FMCE item number 17.
FMCE18 A character of the FMCE item number 18.
FMCE19 A character of the FMCE item number 19.
FMCE20 A character of the FMCE item number 20.
FMCE21 A character of the FMCE item number 21.
FMCE22 A character of the FMCE item number 22.
FMCE23 A character of the FMCE item number 23.
FMCE24 A character of the FMCE item number 24.
FMCE25 A character of the FMCE item number 25.
FMCE26 A character of the FMCE item number 26.
FMCE27 A character of the FMCE item number 27.
FMCE28 A character of the FMCE item number 28.
FMCE29 A character of the FMCE item number 29.
FMCE30 A character of the FMCE item number 30.
FMCE31 A character of the FMCE item number 31.
FMCE32 A character of the FMCE item number 32.
FMCE33 A character of the FMCE item number 33.
FMCE34 A character of the FMCE item number 34.
FMCE35 A character of the FMCE item number 35.
FMCE36 A character of the FMCE item number 36.
FMCE37 A character of the FMCE item number 37.
FMCE38 A character of the FMCE item number 38.
FMCE39 A character of the FMCE item number 39.
FMCE40 A character of the FMCE item number 40.
FMCE41 A character of the FMCE item number 41.
FMCE42 A character of the FMCE item number 42.
FMCE43 A character of the FMCE item number 43.
FMCE44 A character of the FMCE item number 44.
FMCE45 A character of the FMCE item number 45.
FMCE46 A character of the FMCE item number 46.
FMCE47 A character of the FMCE item number 47.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Thornton, R. K. & Sokoloff, D. R. Assessing student learning of Newton's laws: The Force and Motion Conceptual Evaluation and the Evaluation of Active Learning Laboratory and Lecture Curricula. *Am J Phys* 66, 338–352 (1998).

Examples

```
data(FMCE)
```

FMCEkey

The Force and Motion Conceptual Evaluation (FMCE) key dataset

Description

The answers key to analyze the students' obtained score on the FMCE.

Usage

```
data(FMCEkey)
```

Format

A data frame of a key record on the following 47 FMCE items.

- FMCE1 A key of the FMCE item number 1.
- FMCE2 A key of the FMCE item number 2.
- FMCE3 A key of the FMCE item number 3.
- FMCE4 A key of the FMCE item number 4.
- FMCE5 A key of the FMCE item number 5.
- FMCE6 A key of the FMCE item number 6.
- FMCE7 A key of the FMCE item number 7.
- FMCE8 A key of the FMCE item number 8.
- FMCE9 A key of the FMCE item number 9.
- FMCE10 A key of the FMCE item number 10.
- FMCE11 A key of the FMCE item number 11.
- FMCE12 A key of the FMCE item number 12.
- FMCE13 A key of the FMCE item number 13.

FMCE14 A key of the FMCE item number 14.
FMCE15 A key of the FMCE item number 15.
FMCE16 A key of the FMCE item number 16.
FMCE17 A key of the FMCE item number 17.
FMCE18 A key of the FMCE item number 18.
FMCE19 A key of the FMCE item number 19.
FMCE20 A key of the FMCE item number 20.
FMCE21 A key of the FMCE item number 21.
FMCE22 A key of the FMCE item number 22.
FMCE23 A key of the FMCE item number 23.
FMCE24 A key of the FMCE item number 24.
FMCE25 A key of the FMCE item number 25.
FMCE26 A key of the FMCE item number 26.
FMCE27 A key of the FMCE item number 27.
FMCE28 A key of the FMCE item number 28.
FMCE29 A key of the FMCE item number 29.
FMCE30 A key of the FMCE item number 30.
FMCE31 A key of the FMCE item number 31.
FMCE32 A key of the FMCE item number 32.
FMCE33 A key of the FMCE item number 33.
FMCE34 A key of the FMCE item number 34.
FMCE35 A key of the FMCE item number 35.
FMCE36 A key of the FMCE item number 36.
FMCE37 A key of the FMCE item number 37.
FMCE38 A key of the FMCE item number 38.
FMCE39 A key of the FMCE item number 39.
FMCE40 A key of the FMCE item number 40.
FMCE41 A key of the FMCE item number 41.
FMCE42 A key of the FMCE item number 42.
FMCE43 A key of the FMCE item number 43.
FMCE44 A key of the FMCE item number 44.
FMCE45 A key of the FMCE item number 45.
FMCE46 A key of the FMCE item number 46.
FMCE47 A key of the FMCE item number 47.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Hestenes, D., Wells, M. & Swackhamer, G. Force concept inventory. *Phys Teach* 30, 141–158 (1992).

Examples

```
data(FMCIkey)
```

FMCI

The Fluid Mechanics Concept Inventory (FMCI) dataset

Description

The Fluid Mechanics Concept Inventory (FMCI) is developed in 2003 as a conceptual inventory to explore students' ideas of fluid mechanics concepts. The FMCI administers 30 multiple choice items.

Usage

```
data(FMCI)
```

Format

A data frame with 497 observations on the following 30 FMCI multiple choice items. The FMCI numbering system starts from the item 3.

FMCI3 A character of the FMCI item number 3.

FMCI4 A character of the FMCI item number 4.

FMCI5 A character of the FMCI item number 5.

FMCI6 A character of the FMCI item number 6.

FMCI7 A character of the FMCI item number 7.

FMCI8 A character of the FMCI item number 8.

FMCI9 A character of the FMCI item number 9.

FMCI10 A character of the FMCI item number 10.

FMCI11 A character of the FMCI item number 11.

FMCI12 A character of the FMCI item number 12.

FMCI13 A character of the FMCI item number 13.

FMCI14 A character of the FMCI item number 14.

FMCI15 A character of the FMCI item number 15.

FMCI16 A character of the FMCI item number 16.

FMCI17 A character of the FMCI item number 17.

FMCI18 A character of the FMCI item number 18.

FMCI19 A character of the FMCI item number 19.
FMCI20 A character of the FMCI item number 20.
FMCI21 A character of the FMCI item number 21.
FMCI22 A character of the FMCI item number 22.
FMCI23 A character of the FMCI item number 23.
FMCI24 A character of the FMCI item number 24.
FMCI25 A character of the FMCI item number 25.
FMCI26 A character of the FMCI item number 26.
FMCI27 A character of the FMCI item number 27.
FMCI28 A character of the FMCI item number 28.
FMCI29 A character of the FMCI item number 29.
FMCI30 A character of the FMCI item number 30.
FMCI31 A character of the FMCI item number 31.
FMCI32 A character of the FMCI item number 32.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data, VI*, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Martin, J., Mitchell, J. & Newell, T. Development of a concept inventory for fluid mechanics. in *Proceedings of the 33rd Annual Frontiers in Education 2003 vol. 1 T3D* (IEEE, 2003).

Examples

```
data(FMCI)
```

FMCIkey

The Fluid Mechanics Concept Inventory (FMCI) key dataset

Description

The answers key to analyze the students' obtained score on the FMCI.

Usage

```
data(FMCIkey)
```

Format

A data frame of a key record on the following 30 FMCI items. The FMCI numbering system starts from the item 3.

- FMCI3 A key of the FMCI item number 3.
- FMCI4 A key of the FMCI item number 4.
- FMCI5 A key of the FMCI item number 5.
- FMCI6 A key of the FMCI item number 6.
- FMCI7 A key of the FMCI item number 7.
- FMCI8 A key of the FMCI item number 8.
- FMCI9 A key of the FMCI item number 9.
- FMCI10 A key of the FMCI item number 10.
- FMCI11 A key of the FMCI item number 11.
- FMCI12 A key of the FMCI item number 12.
- FMCI13 A key of the FMCI item number 13.
- FMCI14 A key of the FMCI item number 14.
- FMCI15 A key of the FMCI item number 15.
- FMCI16 A key of the FMCI item number 16.
- FMCI17 A key of the FMCI item number 17.
- FMCI18 A key of the FMCI item number 18.
- FMCI19 A key of the FMCI item number 19.
- FMCI20 A key of the FMCI item number 20.
- FMCI21 A key of the FMCI item number 21.
- FMCI22 A key of the FMCI item number 22.
- FMCI23 A key of the FMCI item number 23.
- FMCI24 A key of the FMCI item number 24.
- FMCI25 A key of the FMCI item number 25.
- FMCI26 A key of the FMCI item number 26.
- FMCI27 A key of the FMCI item number 27.
- FMCI28 A key of the FMCI item number 28.
- FMCI29 A key of the FMCI item number 29.
- FMCI30 A key of the FMCI item number 30.
- FMCI31 A key of the FMCI item number 31.
- FMCI32 A key of the FMCI item number 32.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Martin, J., Mitchell, J. & Newell, T. Development of a concept inventory for fluid mechanics. in *Proceedings of the 33rd Annual Frontiers in Education 2003 vol. 1 T3D* (IEEE, 2003).

Examples

```
data(FMCIkey)
```

literacy

Students' literacy dataset

Description

In this package, students' literacy was defined based on two close-ended items asking the accessibility to available books in their home and digital facilities belong to the students.

Usage

```
data(literacy)
```

Format

A data frame with 497 observations on the following 2 literacy items.

LIT1 Do you read books in your home? 1 = Yes, 2 = No

LIT2 Do you access gadgets and the internet in your home? 1 = Yes, 2 = No

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, V1, (2024). doi: 10.17632/88d7m2fv7p.1.

Examples

```
data(literacy)
```

MWCS

The Mechanical Waves Conceptual Survey (MWCS) dataset

Description

The MWCS is the most important test to date that has been designed to evaluate students' understanding of four main topics in mechanical waves. It encompasses some concepts surrounding propagation, superposition, reflection, and standing waves within 22 multiple choice items.

Usage

`data(MWCS)`

Format

A data frame with 497 observations on the following 22 MWCS multiple choice items.

- MWCS1 A character of the MWCS item number 1.
- MWCS2 A character of the MWCS item number 2.
- MWCS3 A character of the MWCS item number 3.
- MWCS4 A character of the MWCS item number 4.
- MWCS5 A character of the MWCS item number 5.
- MWCS6 A character of the MWCS item number 6.
- MWCS7 A character of the MWCS item number 7.
- MWCS8 A character of the MWCS item number 8.
- MWCS9 A character of the MWCS item number 9.
- MWCS10 A character of the MWCS item number 10.
- MWCS11 A character of the MWCS item number 11.
- MWCS12 A character of the MWCS item number 12.
- MWCS13 A character of the MWCS item number 13.
- MWCS14 A character of the MWCS item number 14.
- MWCS15 A character of the MWCS item number 15.
- MWCS16 A character of the MWCS item number 16.
- MWCS17 A character of the MWCS item number 17.
- MWCS18 A character of the MWCS item number 18.
- MWCS19 A character of the MWCS item number 19.
- MWCS20 A character of the MWCS item number 20.
- MWCS21 A character of the MWCS item number 21.
- MWCS22 A character of the MWCS item number 22.

Source

Santos, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Barniol, P. & Zavala, G. Mechanical waves conceptual survey: Its modification and conversion to a standard multiple-choice test. *Phys Rev Phys Educ Res* 12, 010107 (2016).

Examples

```
data(MWCS)
```

MWCSkey

The Mechanical Waves Conceptual Survey (MWCS) key dataset

Description

The answers key to analyze the students' obtained score on the MWCS.

Usage

```
data(MWCSkey)
```

Format

A data frame of a key record on the following 22 MWCS items.

MWCS1 A key of the MWCS item number 1.

MWCS2 A key of the MWCS item number 2.

MWCS3 A key of the MWCS item number 3.

MWCS4 A key of the MWCS item number 4.

MWCS5 A key of the MWCS item number 5.

MWCS6 A key of the MWCS item number 6.

MWCS7 A key of the MWCS item number 7.

MWCS8 A key of the MWCS item number 8.

MWCS9 A key of the MWCS item number 9.

MWCS10 A key of the MWCS item number 10.

MWCS11 A key of the MWCS item number 11.

MWCS12 A key of the MWCS item number 12.

MWCS13 A key of the MWCS item number 13.

MWCS14 A key of the MWCS item number 14.

- MWCS15 A key of the MWCS item number 15.
- MWCS16 A key of the MWCS item number 16.
- MWCS17 A key of the MWCS item number 17.
- MWCS18 A key of the MWCS item number 18.
- MWCS19 A key of the MWCS item number 19.
- MWCS20 A key of the MWCS item number 20.
- MWCS21 A key of the MWCS item number 21.
- MWCS22 A key of the MWCS item number 22.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, V1, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Barniol, P. & Zavala, G. Mechanical waves conceptual survey: Its modification and conversion to a standard multiple-choice test. *Phys Rev Phys Educ Res* 12, 010107 (2016).

Examples

```
data(MWCSkey)
```

physicsidentity	<i>Students' physics identity dataset</i>
-----------------	---

Description

In this study, students' physics identity was defined based on two close-ended items asking the students' study time for physics and the experienced family recognition when they are studying physics.

Usage

```
data(physicsidentity)
```

Format

A data frame with 497 observations on the following 2 physics identity items.

PHYIDE1 When did you study physics outside schools? 1 = Most of the time, 2 = Night before the physics schedule, 3 = Night before exam, 4 = Never

PHYIDE2 Did your parents support you while studying physics? 1 = Yes, 2 = Lack of parental support, 3 = Extremely no

Source

Santos, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Hazari, Z., Sonnert, G., Sadler, P. M. & Shanahan, M. C. Connecting high school physics experiences, outcome expectations, physics identity, and physics career choice: A gender study. *J Res Sci Teach* 47, 978–1003 (2010).

Examples

```
data(physicsidentity)
```

RRMCS

The Rotational and Rolling Motion Conceptual Survey (RRMCS) dataset

Description

The RRMCS could be given to explore students' ideas in various education levels starting in high school to introductory college. It examines students' understanding of rotational motion and notions associated with it through 30 multiple choice items.

Usage

```
data(RRMCS)
```

Format

A data frame with 497 observations on the following 30 RRMCS multiple choice items.

RRMCS1 A character of the RRMCS item number 1.

RRMCS2 A character of the RRMCS item number 2.

RRMCS3 A character of the RRMCS item number 3.

RRMCS4 A character of the RRMCS item number 4.

RRMCS5 A character of the RRMCS item number 5.

RRMCS6 A character of the RRMCS item number 6.

RRMCS7 A character of the RRMCS item number 7.

RRMCS8 A character of the RRMCS item number 8.

RRMCS9 A character of the RRMCS item number 9.

RRMCS10 A character of the RRMCS item number 10.

RRMCS11 A character of the RRMCS item number 11.

- RRMCS12 A character of the RRMCS item number 12.
- RRMCS13 A character of the RRMCS item number 13.
- RRMCS14 A character of the RRMCS item number 14.
- RRMCS15 A character of the RRMCS item number 15.
- RRMCS16 A character of the RRMCS item number 16.
- RRMCS17 A character of the RRMCS item number 17.
- RRMCS18 A character of the RRMCS item number 18.
- RRMCS19 A character of the RRMCS item number 19.
- RRMCS20 A character of the RRMCS item number 20.
- RRMCS21 A character of the RRMCS item number 21.
- RRMCS22 A character of the RRMCS item number 22.
- RRMCS23 A character of the RRMCS item number 23.
- RRMCS24 A character of the RRMCS item number 24.
- RRMCS25 A character of the RRMCS item number 25.
- RRMCS26 A character of the RRMCS item number 26.
- RRMCS27 A character of the RRMCS item number 27.
- RRMCS28 A character of the RRMCS item number 28.
- RRMCS29 A character of the RRMCS item number 29.
- RRMCS30 A character of the RRMCS item number 30.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Rimoldini, L. G. & Singh, C. Student understanding of rotational and rolling motion concepts. *Physical Review Special Topics - Physics Education Research* 1, 010102 (2005).

Examples

```
data(RRMCS)
```

RRMCSkey

The Rotational and Rolling Motion Conceptual Survey (RRMCS) key dataset

Description

The answers key to analyze the students' obtained score on the RRMCS.

Usage

`data(RRMCSkey)`

Format

A data frame of a key record on the following 47 RRMCS items.

RRMCS1 A key of the RRMCS item number 1.
RRMCS2 A key of the RRMCS item number 2.
RRMCS3 A key of the RRMCS item number 3.
RRMCS4 A key of the RRMCS item number 4.
RRMCS5 A key of the RRMCS item number 5.
RRMCS6 A key of the RRMCS item number 6.
RRMCS7 A key of the RRMCS item number 7.
RRMCS8 A key of the RRMCS item number 8.
RRMCS9 A key of the RRMCS item number 9.
RRMCS10 A key of the RRMCS item number 10.
RRMCS11 A key of the RRMCS item number 11.
RRMCS12 A key of the RRMCS item number 12.
RRMCS13 A key of the RRMCS item number 13.
RRMCS14 A key of the RRMCS item number 14.
RRMCS15 A key of the RRMCS item number 15.
RRMCS16 A key of the RRMCS item number 16.
RRMCS17 A key of the RRMCS item number 17.
RRMCS18 A key of the RRMCS item number 18.
RRMCS19 A key of the RRMCS item number 19.
RRMCS20 A key of the RRMCS item number 20.
RRMCS21 A key of the RRMCS item number 21.
RRMCS22 A key of the RRMCS item number 22.
RRMCS23 A key of the RRMCS item number 23.
RRMCS24 A key of the RRMCS item number 24.

RRMCS25 A key of the RRMCS item number 25.

RRMCS26 A key of the RRMCS item number 26.

RRMCS27 A key of the RRMCS item number 27.

RRMCS28 A key of the RRMCS item number 28.

RRMCS29 A key of the RRMCS item number 29.

RRMCS30 A key of the RRMCS item number 30.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, *V1*, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Rimoldini, L. G. & Singh, C. Student understanding of rotational and rolling motion concepts. *Physical Review Special Topics - Physics Education Research* *1*, 010102 (2005).

Examples

```
data(RRMCSkey)
```

SAAR

The Scientific Abilities Assessment Rubrics (SAAR) dataset

Description

The SAAR is developed as a qualitative scoring rubric intended to measure students' scientific abilities within the environment of physics laboratory. A rating scale with four categories (1–4) is used in this dataset to describe the students' work in the laboratory (1, missing; 2, inadequate; 3, needs some improvement; and 4, adequate) and devised descriptions of student work that could merit a particular score. In this package, we merely measure some abilities from the SAAR since they could be more relevant and important for the high school physics laboratory. They are the ability to design & conduct an observational experiment (Rubric B), the ability to communicate scientific ideas (Rubric F), and the ability to collect and analyze experimental data (Rubric G).

Usage

```
data(SAAR)
```

Format

A data frame with 497 observations on the following 16 SAAR observation items in the physics laboratory.

SAAR-B1 A numeric of the observation using the SAAR on the Rubric B item 1.

SAAR-B2 A numeric of the observation using the SAAR on the Rubric B item 2.

SAAR-B3 A numeric of the observation using the SAAR on the Rubric B item 3.

SAAR-B4 A numeric of the observation using the SAAR on the Rubric B item 4.

SAAR-B5 A numeric of the observation using the SAAR on the Rubric B item 5.

SAAR-B6 A numeric of the observation using the SAAR on the Rubric B item 6.

SAAR-B7 A numeric of the observation using the SAAR on the Rubric B item 7.

SAAR-B8 A numeric of the observation using the SAAR on the Rubric B item 8.

SAAR-B9 A numeric of the observation using the SAAR on the Rubric B item 9.

SAAR-F10 A numeric of the observation using the SAAR on the Rubric F item 1 (SAAR item 10).

SAAR-F11 A numeric of the observation using the SAAR on the Rubric F item 2 (SAAR item 11).

SAAR-G12 A numeric of the observation using the SAAR on the Rubric G item 1 (SAAR item 12).

SAAR-G13 A numeric of the observation using the SAAR on the Rubric G item 2 (SAAR item 13).

SAAR-G14 A numeric of the observation using the SAAR on the Rubric G item 3 (SAAR item 14).

SAAR-G15 A numeric of the observation using the SAAR on the Rubric G item 4 (SAAR item 15).

SAAR-G16 A numeric of the observation using the SAAR on the Rubric G item 5 (SAAR item 16).

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1

References

Etkina, E. et al. Scientific abilities and their assessment. *Physical Review Special Topics - Physics Education Research* 2, 020103 (2006).

Examples

```
data(SAAR)
```

STPFASL	<i>The Survey of Thermodynamic Processes and First and Second Laws (STPFASL) dataset</i>
---------	--

Description

The STPFASL instrument demonstrates 33 items in multiple-choice format that are written based on common student difficulties of thermodynamics as resources in that the incorrect answers to the multiple-choice questions were guided by them.

Usage

```
data(STPFASL)
```

Format

A data frame with 497 observations on the following 47 STPFASL multiple choice items.

STPFASL1 A character of the STPFASL item number 1.
STPFASL2 A character of the STPFASL item number 2.
STPFASL3 A character of the STPFASL item number 3.
STPFASL4 A character of the STPFASL item number 4.
STPFASL5 A character of the STPFASL item number 5.
STPFASL6 A character of the STPFASL item number 6.
STPFASL7 A character of the STPFASL item number 7.
STPFASL8 A character of the STPFASL item number 8.
STPFASL9 A character of the STPFASL item number 9.
STPFASL10 A character of the STPFASL item number 10.
STPFASL11 A character of the STPFASL item number 11.
STPFASL12 A character of the STPFASL item number 12.
STPFASL13 A character of the STPFASL item number 13.
STPFASL14 A character of the STPFASL item number 14.
STPFASL15 A character of the STPFASL item number 15.
STPFASL16 A character of the STPFASL item number 16.
STPFASL17 A character of the STPFASL item number 17.
STPFASL18 A character of the STPFASL item number 18.
STPFASL19 A character of the STPFASL item number 19.
STPFASL20 A character of the STPFASL item number 20.
STPFASL21 A character of the STPFASL item number 21.
STPFASL22 A character of the STPFASL item number 22.

STPFASL23 A character of the STPFASL item number 23.
STPFASL24 A character of the STPFASL item number 24.
STPFASL25 A character of the STPFASL item number 25.
STPFASL26 A character of the STPFASL item number 26.
STPFASL27 A character of the STPFASL item number 27.
STPFASL28 A character of the STPFASL item number 28.
STPFASL29 A character of the STPFASL item number 29.
STPFASL30 A character of the STPFASL item number 30.
STPFASL31 A character of the STPFASL item number 31.
STPFASL32 A character of the STPFASL item number 32.
STPFASL33 A character of the STPFASL item number 33.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Brown, B. & Singh, C. Development and validation of a conceptual survey instrument to evaluate students' understanding of thermodynamics. *Phys Rev Phys Educ Res* 17, 010104 (2021).

Examples

```
data(STPFASL)
```

STPFASLkey

The Survey of Thermodynamic Processes and First and Second Laws (STPFASL) key dataset

Description

The answers key to analyze the students' obtained score on the STPFASL.

Usage

```
data(STPFASLkey)
```

Format

A data frame of a key record on the following 33 STPFASL items.

STPFASL1 A key of the STPFASL item number 1.

STPFASL2 A key of the STPFASL item number 2.

STPFASL3 A key of the STPFASL item number 3.

STPFASL4 A key of the STPFASL item number 4.

STPFASL5 A key of the STPFASL item number 5.

STPFASL6 A key of the STPFASL item number 6.

STPFASL7 A key of the STPFASL item number 7.

STPFASL8 A key of the STPFASL item number 8.

STPFASL9 A key of the STPFASL item number 9.

STPFASL10 A key of the STPFASL item number 10.

STPFASL11 A key of the STPFASL item number 11.

STPFASL12 A key of the STPFASL item number 12.

STPFASL13 A key of the STPFASL item number 13.

STPFASL14 A key of the STPFASL item number 14.

STPFASL15 A key of the STPFASL item number 15.

STPFASL16 A key of the STPFASL item number 16.

STPFASL17 A key of the STPFASL item number 17.

STPFASL18 A key of the STPFASL item number 18.

STPFASL19 A key of the STPFASL item number 19.

STPFASL20 A key of the STPFASL item number 20.

STPFASL21 A key of the STPFASL item number 21.

STPFASL22 A key of the STPFASL item number 22.

STPFASL23 A key of the STPFASL item number 23.

STPFASL24 A key of the STPFASL item number 24.

STPFASL25 A key of the STPFASL item number 25.

STPFASL26 A key of the STPFASL item number 26.

STPFASL27 A key of the STPFASL item number 27.

STPFASL28 A key of the STPFASL item number 28.

STPFASL29 A key of the STPFASL item number 29.

STPFASL30 A key of the STPFASL item number 30.

STPFASL31 A key of the STPFASL item number 31.

STPFASL32 A key of the STPFASL item number 32.

STPFASL33 A key of the STPFASL item number 33.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Brown, B. & Singh, C. Development and validation of a conceptual survey instrument to evaluate students' understanding of thermodynamics. *Phys Rev Phys Educ Res* 17, 010104 (2021).

Examples

```
data(STPFASLkey)
```

TCE

The Thermal Concept Evaluation (TCE) dataset

Description

There are 26 multiple-choice items in the TCE examining students' alternative concepts on heat, temperature, heat transfer and temperature change, and thermal properties. The alternative concepts are discovered based on former studies, and they are used as a researcher basis to construct the TCE distractors.

Usage

```
data(TCE)
```

Format

A data frame with 497 observations on the following 26 TCE multiple choice items.

- TCE1 A character of the TCE item number 1.
- TCE2 A character of the TCE item number 2.
- TCE3 A character of the TCE item number 3.
- TCE4 A character of the TCE item number 4.
- TCE5 A character of the TCE item number 5.
- TCE6 A character of the TCE item number 6.
- TCE7 A character of the TCE item number 7.
- TCE8 A character of the TCE item number 8.
- TCE9 A character of the TCE item number 9.
- TCE10 A character of the TCE item number 10.
- TCE11 A character of the TCE item number 11.
- TCE12 A character of the TCE item number 12.

- TCE13 A character of the TCE item number 13.
- TCE14 A character of the TCE item number 14.
- TCE15 A character of the TCE item number 15.
- TCE16 A character of the TCE item number 16.
- TCE17 A character of the TCE item number 17.
- TCE18 A character of the TCE item number 18.
- TCE19 A character of the TCE item number 19.
- TCE20 A character of the TCE item number 20.
- TCE21 A character of the TCE item number 21.
- TCE22 A character of the TCE item number 22.
- TCE23 A character of the TCE item number 23.
- TCE24 A character of the TCE item number 24.
- TCE25 A character of the TCE item number 25.
- TCE26 A character of the TCE item number 26.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Yeo, S. & Zadnik, M. Introductory thermal concept evaluation: assessing students' understanding. *Phys Teach* 39, 496–504 (2001).

Examples

```
data(TCE)
```

TCEkey

The Thermal Concept Evaluation (TCE) key dataset

Description

The answers key to analyze the students' obtained score on the TCE.

Usage

```
data(TCEkey)
```

Format

A data frame of a key record on the following 26 TCE items.

- TCE1 A key of the TCE item number 1.
- TCE2 A key of the TCE item number 2.
- TCE3 A key of the TCE item number 3.
- TCE4 A key of the TCE item number 4.
- TCE5 A key of the TCE item number 5.
- TCE6 A key of the TCE item number 6.
- TCE7 A key of the TCE item number 7.
- TCE8 A key of the TCE item number 8.
- TCE9 A key of the TCE item number 9.
- TCE10 A key of the TCE item number 10.
- TCE11 A key of the TCE item number 11.
- TCE12 A key of the TCE item number 12.
- TCE13 A key of the TCE item number 13.
- TCE14 A key of the TCE item number 14.
- TCE15 A key of the TCE item number 15.
- TCE16 A key of the TCE item number 16.
- TCE17 A key of the TCE item number 17.
- TCE18 A key of the TCE item number 18.
- TCE19 A key of the TCE item number 19.
- TCE20 A key of the TCE item number 20.
- TCE21 A key of the TCE item number 21.
- TCE22 A key of the TCE item number 22.
- TCE23 A key of the TCE item number 23.
- TCE24 A key of the TCE item number 24.
- TCE25 A key of the TCE item number 25.
- TCE26 A key of the TCE item number 26.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, V1, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Yeo, S. & Zadnik, M. Introductory thermal concept evaluation: assessing students' understanding. *Phys Teach* 39, 496–504 (2001).

Examples

```
data(TCEkey)
```

teachersjudgment *Teachers' judgment dataset*

Description

In this study, physics teachers are studied to predict the binary state of their students' performance at the final second semester.

Usage

```
data(teachersjudgment)
```

Format

A data frame with 497 rows of final test assessments and prediction reported by physics teachers.

FINTEST1 Students' score on the final test at the first semester using teachers developed items.

FINTEST2 Students' score on the final test at the second semester using teachers developed items.

TEACHPRED Students' performance state as predicted by physics teachers intuitively. 1 = higher ability, 0 = lower ability.

Source

Santoso, P. H. et al. SPHERE: Students' performance dataset of conceptual understanding, scientific ability, and learning attitude in physics education research (PER). *Mendeley Data*, VI, (2024). doi: 10.17632/88d7m2fv7p.1.

References

Zhu, C. & Urhahne, D. Temporal stability of teachers' judgment accuracy of students' motivation, emotion, and achievement. *European Journal of Psychology of Education* 36, 319–337 (2021).

Examples

```
data(teachersjudgment)
```

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