## Entwicklung eines diagnostischen Tests zur Identifizierung von Fehlkonzepten in spezifischen inhaltlichen Bereichen in 10 Schritten

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| | Schritt | Beschreibung |
|---|---|---|
| **Inhaltliche Bestimmung** | 1 | Formulieren von Wissensaussagen, Beschreibung von Fachwissen aus einem definierten inhaltlichen Bereich |
| | 2 | Aufstellen von Conceptmaps, zeigen Schülervorstellungen und Konzepte |
| | 3 | Fachwissen und Konzepte abgleichen, Verlässlichkeit überprüfen, Inhalte sind in sich konsistent? |
| | 4 | Validieren durch Experten, Lehrer! Alle Unstimmigkeiten ausmerzen, korrigieren und modifizieren |
| **Informationen zu Fehlkonzepten** | 5 | Literatur durchsehen, begutachten, auf die Inhalte bezogene Fehlkonzepte recherchieren |
| | 6 | Unstrukturierte Gespräche / Interviews mit Schülern, identifizieren von Schülervorstellungen und Fehlkonzepten, alles was Diskrepanzen zu Lehrererwartungen aufweist festhalten |
| | 7 | Multiple Choice Items entwickeln, jedes Item bezogen auf Wissensaussagen und Fehlkonzepte, Raum für Begründungen durch Schüler lassen |
| **Entwicklung eines Diagnosebogens** | 8 | Zweistufigen Diagnosetest auf der Grundlage von (8) entwickeln: erster Teil ist MC Frage mit 2-3 Auswahlantworten, zweiter Teil bietet einen Satz von 4-5 Begründungen für die Auswahl,<br>richtige Begründung, typische Fehlkonzepte und evtl. klar falsche Begründung (entwickelt aus (5-7)) |
| | 9 | Items in übersichtlichem Raster anlegen, sicher stellen, dass der Test alle relevanten inhaltlichen Bereiche abdeckt |
| | 10 | Kontinuierliche Vervollkommnung durch wiederholten Einsatz |

These students construct sensible and coherent understandings
of phenomena and concepts as seen through their own eyes that do not match the views that are universally accepted by the scientific community. The resulting misunderstandings or alternative conceptions, if not challenged, become integrated into students' cognitive structures and interfere with subsequent learning. As a consequence, students will experience difficulty in integrating any new information within their cognitive structures, resulting in an inappropriate understanding of the new concept.....
Other research shows that the majority of teachers do not effectively diagnose students'

learning problems, especially at an early stage of the student learning process
….how teachers can address students' learning needs by
incorporating in their instructional repertoires specially designed assessment procedures that are consistent with constructivist teaching approaches and are an integral part of that teaching…..

Wiggins and
McTigue (1998) recommend redesigning the curriculum in a way that includes informal and formal assessment procedures for understanding as part of the curriculum. These authors recommend that teachers use a wide range of both formative and summative assessment methods to gain feedback on student learning. The difficulty with most effective methods is that they are very time consuming and rarely practical for busy classroom teachers to create.

Water ($H_2O$) and hydrogen sulphide ($H_2S$) have similar chemical formulae and have V-shaped structures. At room temperature, water is a liquid and hydrogen sulphide a gas. The difference in state between water and hydrogen sulphide is due to the presence of strong intermolecular forces between

(1) $H_2O$ molecules (2) $H_2S$ molecules

*Reason*

(*a*) The difference in strength of the intermolecular forces is due to differences in the strength of the O–H and S–H covalent bonds.

(*b*) The bonds in $H_2S$ are easily broken, whereas in $H_2O$ they are not.

(*c*) The difference in strength of the intermolecular forces is due to the difference in polarity of the molecules.

(*d*) The difference in strength of the intermolecular forces is due to the fact that $H_2O$ is a polar molecule, and $H_2S$ is a non-polar molecule.

| | | | | Reason | | | | |
|---|---|---|---|---|---|---|---|---|
| Class | Year | *N* | Choice | (*a*) | (*b*) | (*c*) | (*d*) | Total |
| 1 | 11 | 159 | 1 | 13·8 | 49·1 | 10·7* | 13·8 | 87·4 |
| | | | 2 | 4·4 | 4·4 | 2·5 | 1·3 | 12·6 |
| 2 | 12 | 84 | 1 | 22·9 | 16·9 | 32·5* | 25·3 | 97·6 |
| | | | 2 | 0·0 | 0·0 | 2·4 | 0·0 | 2·4 |
| 3 | 13 | 37 | 1 | 43·2 | 29·7 | 18·9* | 8·2 | 100·0 |
| | | | 2 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| 4 | 13 | 45 | 1 | 40·0 | 24·4 | 17·8* | 6·7 | 88·9 |
| | | | 2 | 2·2 | 0·0 | 6·7 | 2·2 | 11·1 |

*the correct choice and reason response

Which gas is taken in by green plants in large amounts, when there is no light energy at all?

(1) carbon dioxide gas
(2) oxygen gas.

The reason for my answer is because:

(*a*) This gas is used in photosynthesis which occurs in green plants all the time.

(*b*) This gas is used in photosynthesis which occurs in green plants when there is no light energy at all.

(*c*) This gas is used in respiration which only occurs in green plants when there is no light energy to photosynthesize.

(*d*) This gas is used in respiration which takes place continuously in green plants.

(*e*) _____

| | | | Reason | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | *N* | Choice | (*a*) | (*b*) | (*c*) | (*d*) | (*e*) | No reason | Total |
| 8 | 137 | 1 | 14·6 | 16·8 | 10·9 | 16·1 | — | 2·9 | 61·3 |
| | | 2 | 7·3 | 10·2 | 11·7 | 8·8* | — | 0·7 | 38·7 |
| 9 | 88 | 1 | 11·4 | 5·7 | 20·5 | 17·0 | — | 1·1 | 55·7 |
| | | 2 | 3·4 | 18·2 | 11·4 | 11·4* | — | — | 44·3 |
| 10 | 99 | 1 | 8·1 | 11·1 | 11·2 | 24·2 | 4·0 | — | 58·6 |
| | | 2 | 3·0 | 8·1 | 23·2 | 7·1* | — | — | 41·4 |
| 11 | 68 | 1 | 7·4 | 1·5 | 8·8 | 17·6 | — | — | 35·3 |
| | | 2 | 1·5 | 1·5 | 33·8 | 27·9* | — | — | 64·7 |
| 12 | 49 | 1 | — | — | 6·1 | 6·1 | — | — | 12·2 |
| | | 2 | — | — | 14·3 | 65·3* | 4·1 | 4·1 | 87·8 |

*the correct choice and reason response
—no responses in this category

Literatur: Treagust, David F.: Development and use of diagnostic tests to evaluate students' misconceptions in science, in Int. J. Sci. Educ. (1988), Vol 10, No.2, 159-169