

Aspects of feedback design in STACK

Guido Pinkernell
Heidelberg, Germany

www.pinkernell.online

1. adaptive feedback
2. feedback parameters
3. examples from the “Heidelberger MatheBrücke”
4. thinking further: activating feedback

adaptive feedback

- information about performance aiming at closing the gap between “what is understood and what is aimed to be understood”
(Sadler, 1989, Mory, 2004; Hattie & Timperley, 2007)
- when addressed to the learner,
acceptable when perceived as “advice for action”,
i.e. adapted to individual’s needs
(Ras, Whitelock, & Kalz, 2016)
- adaption as
 - adjustment to an individual’s actual performance
within an ongoing learning process
(Leutner, 1992)
 - adjustment to an individual’s needs
within a heterogeneous group

1. adaptive feedback
2. feedback parameters
3. examples from the “Heidelberger MatheBrücke”
4. thinking further: activating feedback

feedback parameters

- content
- modality
- load
- language
- timing

(Mory, 2004; Shute, 2008; Ras, Whitelock, & Kalz, 2016)

feedback parameters

- **content**
- **modality**
- **load**
- **language**
- **timing**

(Mory, 2004; Shute, 2008; Ras, Whitelock, & Kalz, 2016)

Content-Related Classification of Feedback Components	
Category	Examples
Knowledge of performance (KP)	15 or 20 correct; 85% correct
Knowledge of result/response (KR)	Correct/incorrect
Knowledge of the correct results (KCR)	Description/indication of the correct response
<i>Elaborated concepts</i>	
Knowledge about task constraints (KTC)	Hints/explanations on type of task
	Hints/explanations on task-processing rules
	Hints/explanations on subtasks
	Hints/explanations on task requirements
Knowledge about concepts (KC)	Hints/explanations on technical terms
	Examples illustrating the concept
	Hints/explanations on the conceptual context
	Hints/explanations on concept attributes
Knowledge about mistakes (KM)	Attribute-isolation examples
	Number of mistakes
	Location of mistakes
	Hints/explanations on type of errors
Knowledge about how to proceed (KH)	Hints/explanations on sources of errors
	Bug-related hints for error correction
	Hints/explanations on task-specific strategies
	Hints/explanations on task-processing steps
Knowledge about metacognition (KMC)	Guiding questions
	Worked-out examples
	Hints/explanations on metacognitive strategies
	Metacognitive guiding questions

(Narciss, 2008)

feedback parameters

- **content**
- modality
- load
- language
- timing

(Mory, 2004; Shute, 2008; Ras, Whitelock, & Kalz, 2016)

for experts,
corrective or thought provoking feedback
seems sufficient

(Chi, Siler, Jeong, Yamauchi & Hausmann, 2001;
Quintana, Zhang & Krajcik, 2005; Johnson & Priest,
2005; Ras et al., 2016)

for novices,
scaffolding or worked out examples
are needed

(Kirschner, Sweller & Clark, 2006; Renkl, 2002;
Renkl & Atkinson, 2003)

feedback parameters

- content
- modality
- load
- language
- **timing**

immediate: as quickly
as the computer allows
delayed: up to several hours
or days
(Dempsey & Wager, 1988)
or after second try
(Richards, 1989)

(Mory, 2004; Shute, 2008; Ras, Whitelock, & Kalz, 2016)

feedback parameters

- content
- modality
- load
- language
- **timing**

(Mory, 2004; Shute, 2008; Ras, Whitelock, & Kalz, 2016)

for low achievers, prompt timing,
for high achievers, delayed timing
of feedback seems suitable
(Shute, 2008)

when testing declarative knowledge
feedback after second try more effective
(Richards, 1989)

“Give a moment to think it over...”
(Mory, 2008)

examples

- **worked-out example**
- thought provoking

(Gulden, 2019; Pinkernell et al., 2020)

*Appears
without
delay*

KR: “Unfortunately, your answer is wrong.”
KCR: “The correct solution is...”
KH: “And this is how it is done correctly:...”

“Load another question
and try again!”

examples

- **worked-out example**
- **thought provoking**

(Gulden, 2019; Pinkernell et al., 2020)

<i>Appears without delay</i>	KR: “Unfortunately, your answer is wrong.”
	KCR: “The correct solution is...”
	KH:

BPA03

Berechne und kürze vollständig:

$$\frac{2}{12} + \frac{3}{6} = 5/18$$

Meintest du diesen Ausdruck?

$$\frac{5}{18}$$

Wenn nicht, dann korrigiere deine Eingabe.

Schade, leider falsch.

Die richtige Lösung ist $\frac{2}{3}$ und so kommt man darauf:

$$\begin{aligned} & \frac{2}{12} + \frac{3}{6} \\ &= \frac{2 \cdot 1}{12 \cdot 1} + \frac{3 \cdot 2}{6 \cdot 2} \\ &= \frac{2}{12} + \frac{6}{12} \\ &= \frac{2+6}{12} \\ &= \frac{8}{12} \\ &= \frac{2}{3} \end{aligned}$$

Versuche die gleiche Aufgabe noch einmal!

Noch einmal versuchen? [Klicke hier!](#)

examples

- worked-out example
- **thought provoking**

(Gulden, 2019; Pinkernell et al., 2020)

*Appears
without
delay*

KR: “Unfortunately, your answer is wrong.”		
KM: “You probably made this error:...”	or	KTC: “The first step of the correct solution would be...”

“Load another question
and try again!”

*Appears
after 60
sec. delay*

KH: “And this is how it is done correctly:...”
--

examples

- worked-out example
- **thought provoking**

(Gulden, 2019; Pinkernell et al., 2020)

KR: "Unfortunately, your answer is wrong."

BPA06

Berechne und kürze vollständig:

$$\frac{1}{3} : \frac{4}{6} = 2$$

Meintest du diesen Ausdruck?

2

Wenn nicht, dann korrigiere deine Eingabe.

Schade, leider falsch.

Es sieht so aus, als hättest du von dem ersten Bruch den Kehrbuch gebildet und diesen mit dem zweiten Bruch multipliziert. Das ist leider nicht ganz richtig. Kannst du dich erinnern, wie es richtig geht? Da Wenn du noch immer überhaupt keine Idee has

[Klicke hier für die Musterlösung](#)

[Noch einmal versuchen? Klicke hier!](#)

[Klicke hier für die Musterlösung](#)

$$\begin{aligned} & \frac{5}{6} - \frac{2}{5} \\ &= \frac{5 \cdot 5}{6 \cdot 5} - \frac{2 \cdot 6}{5 \cdot 6} \\ &= \frac{25}{30} - \frac{12}{30} \\ &= \frac{25-12}{30} \\ &= \frac{13}{30} \\ &= \frac{13}{30} \end{aligned}$$

Versuche die gleiche Aufgabe noch einmal!

examples

- **worked-out example**
- **thought provoking**

(Gulden, 2019; Pinkernell et al., 2020)

<i>Appears without delay</i>	KR: “Unfortunately, your answer is wrong.”
	KCR: “The correct solution is...”
	KH: “And this is how it is done correctly:...”
	“Load another question and try again!”

<i>Appears without delay</i>	KR: “Unfortunately, your answer is wrong.”	
	KM: “You probably made this error:...”	KTC: “The first step or of the correct solution would be...”
	“Load another question and try again!”	
<i>Appears after 60 sec. delay</i>	KH: “And this is how it is done correctly:...”	

Which is more effective?

Error detection or worked out example?

Examining two types of feedback in the case of elementary arithmetic with fractions

(Gulden, 2019)

examples

- **worked-out example**
- **thought provoking**

(Gulden, 2019; Pinkernell et al., 2020)

<i>Appears without delay</i>	KR: “Unfortunately, your answer is wrong.”
	KCR: “The correct solution is...”
	KH: “And this is how it is done correctly:...”
	“Load another question and try again!”

<i>Appears without delay</i>	KR: “Unfortunately, your answer is wrong.”	
	KM: “You probably made this error:...”	KTC: “The first step or of the correct solution would be...”
	“Load another question and try again!”	
<i>Appears after 60 sec. delay</i>	KH: “And this is how it is done correctly:...”	

Information about error made
possibly more effective on performance
than worked out example – why?

Pupils were not novices on subject,
for which worked out examples
would have been the preferred
type of feedback...
(Kirschner, Sweller & Clark, 2006)

examples

- **worked-out example**
- **thought provoking**

(Gulden, 2019; Pinkernell et al., 2020)

<i>Appears without delay</i>	KR: “Unfortunately, your answer is wrong.”
	KCR: “The correct solution is...”
	KH: “And this is how it is done correctly:...”
	“Load another question and try again!”

<i>Appears without delay</i>	KR: “Unfortunately, your answer is wrong.”	
	KM: “You probably made this error:...”	KTC: “The first step or of the correct solution would be...”
	“Load another question and try again!”	
<i>Appears after 60 sec. delay</i>	KH: “And this is how it is done correctly:...”	

Information about error made
possibly more effective on performance
than worked out example – why?

... i.e. worked out examples
did not contain information new to pupils or
could even interfere with individual's
preferred solving strategies
(Renkl & Atkinson, 2003)

1. adaptive feedback
2. feedback parameters
3. examples from the “Heidelberger MatheBrücke”
4. thinking further: activating feedback

feedback parameters + 1

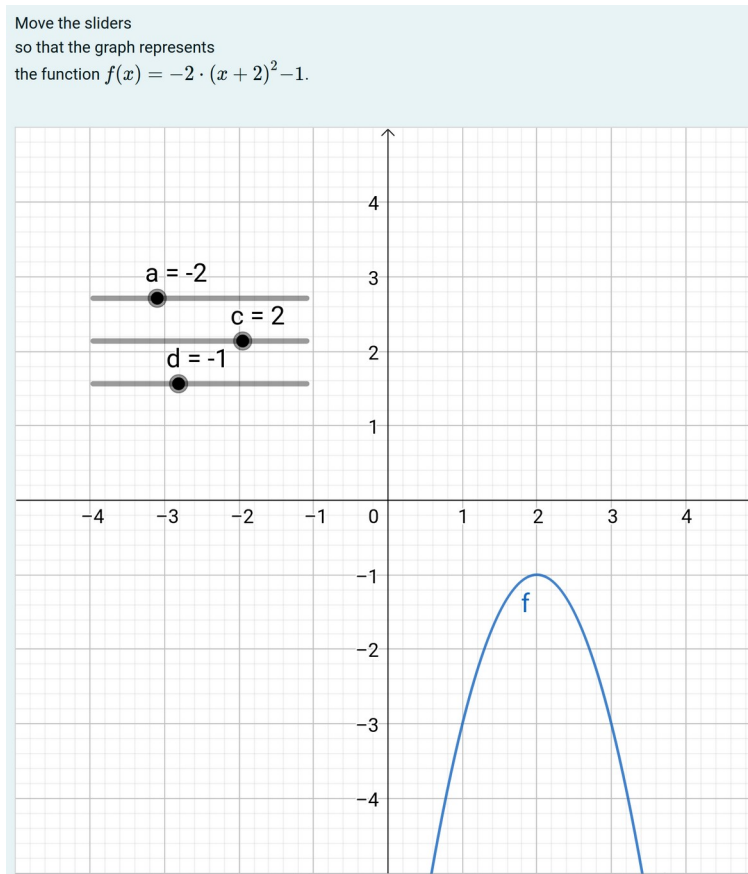
- content
- modality
- load
- language
- timing
- **activation**

idea

- turning receptive into active behaviour
- adding enactive to cognitive engagement

examples

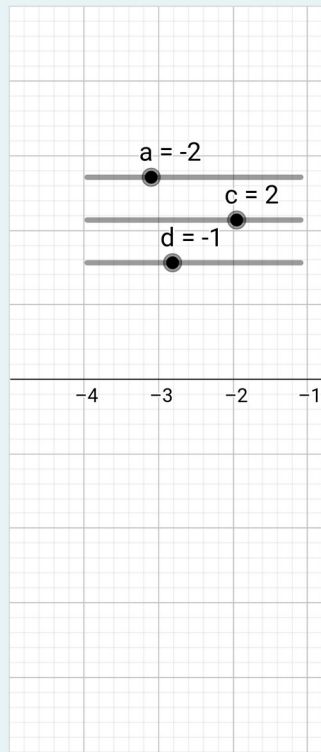
- worked-out example
- thought provoking
- **activating**



examples

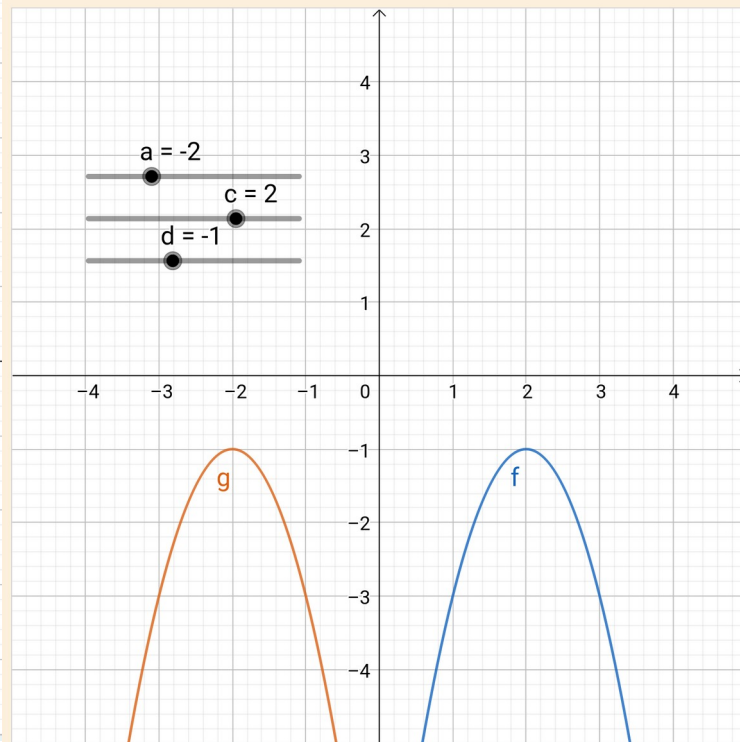
- worked-out example
- thought provoking
- **activating**

Move the sliders
so that the graph represents
the function $f(x) = -2 \cdot (x + 2)^2 - 1$.



Sorry, you got it wrong

Here is your wrong solution and the correct for comparison:



Correct your solution by moving the sliders again.

Find out yourself:

What is the effect of each slider?

Which slider would you move first, which second, which last?

examples

- worked-out example
- thought provoking
- **activating**

Teile $\frac{3}{4}$ durch $\frac{5}{2}$ und gib das gekürzte Ergebnis an.

$$\frac{3}{4} : \frac{5}{2} = \text{10/3}$$

Ihre letzte Antwort wurde folgendermaßen interpretiert:

$$\frac{10}{3}$$

Schade, leider falsch.

Du hast vermutlich vom ersten Bruch den Kehrbuch gebildet und mit dem zweiten Bruch multipliziert (·).

Das ist leider nicht richtig.

Hast Du eine Idee wie es richtig geht? Dann ändere oben Deine Antwort und klicke unten auf "Prüfen".

Wenn nicht, dann erscheint in ca. 30 Sekunden ein "Weiter-Button".

Klicke darauf und Du bekommst einen Tipp.

1. step
thought
provoking
delay

examples

- worked-out example
- thought provoking
- **activating**

Teile $\frac{3}{4}$ durch $\frac{5}{2}$ und gib das gekürzte Ergebnis an.

$$\frac{3}{4} : \frac{5}{2} = \text{10/3}$$

Ihre letzte Antwort wurde folgendermaßen interpretiert:

$$\frac{10}{3}$$

Schade, leider falsch.

Tipp

Versuche folgende Ziele zu erreichen:

1. Den Kehrbruch des zweiten Bruches bilden
2. Den ersten Bruch mit dem Kehrbruch des zweiten Bruches multiplizieren (-)
3. Wenn möglich kürzen

Weißt Du nun wie es richtig geht? Dann ändere oben Dein Ergebnis und klicke unten auf "Prüfen".

Wenn nicht, dann erscheint in ca. 30 Sekunden unten ein neuer "Weiter-Button".

Klicke darauf und Du bekommst eine weitere Hilfe.

1. step
thought
provoking
delay

2. step
process
information
delay

examples

- worked-out example
- thought provoking
- **activating**

Teile $\frac{3}{4}$ durch $\frac{5}{2}$ und gib das gekürzte Ergebnis an.

$$\frac{3}{4} : \frac{5}{2} = \boxed{10/3}$$

Ihre letzte Antwort wurde folgendermaßen interpretiert:

$$\frac{10}{3}$$

Schade, leider falsch.

Tipp

Versuch **Lösung**

1. De Berechne $\frac{3}{4} : \frac{5}{2}$

2. De

1. Den Kehrbruch des zweiten Bruches bilden

3. We

Der Kehrbruch von $\frac{5}{2}$ ist $\frac{2}{5}$

Weißt

"Prüfe

Schau genau hin: Wie bildet man einen Kehrbruch?

Wenn

☐

Zähler und Nenner des ersten Bruches übernehmen.

☐

Zähler und Nenner des Bruches mit der gleichen Zahl multiplizieren (·).

☐

Zähler und Nenner des Bruches vertauschen

1. step
thought
provoking
delay

2. step
process
information
delay

3. step a
prompts
or

examples

- worked-out example
- thought provoking
- activating

Teile $\frac{3}{4}$ durch $\frac{5}{2}$ und gib das gekürzte Ergebnis an.

$$\frac{3}{4} : \frac{5}{2} = \text{10/3}$$

Ihre letzte Antwort wurde folgendermaßen interpretiert:

$$\frac{10}{3}$$

Schade, leider falsch.

Tipp

Fülle folgende Lücken aus

Versuch Lösung

Berechne $\frac{3}{4} : \frac{5}{2}$

1. Dein Berec

1. Den Kehbruch des zweiten Bruches bilden

2. Dein

1. Dein

3. Wenn

Der Kehbruch von $\frac{5}{2}$ ist

Der K

Weißt

"Prüfe

Schalt

2. Den ersten Bruch mit dem Kehbruch des zweiten Bruches multiplizieren (·)

Wenn

☐ Z

Klicke

☐ Z

☐ Z

$$= \text{ } \cdot \text{ }$$

1. step
thought
provoking
delay

2. step
process
information
delay

3. step a
prompts
or
step b
cloze worked-
out example

- content
- modality
- load
- language
- timing
- **activation**

idea

- turning receptive into active behaviour
- adding enactive to cognitive engagement

by means of

- interactive graphic applets
- cloze texts
- ...

feedback message

- “here is material
to find out yourself
how it is done correctly”

Thank you

www.pinkernell.online