

# Using – Analysing – Creating – Embedding

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# Reference: Curriculum<sup>1</sup> of Secondary Computing Education Mecklenburg/Western Pomerania (2002)

The implementation of the topics typically follows three steps

- ▶ **Using**
- ▶ **Analysing**
- ▶ **Creating**

⇒ **What does that mean?**

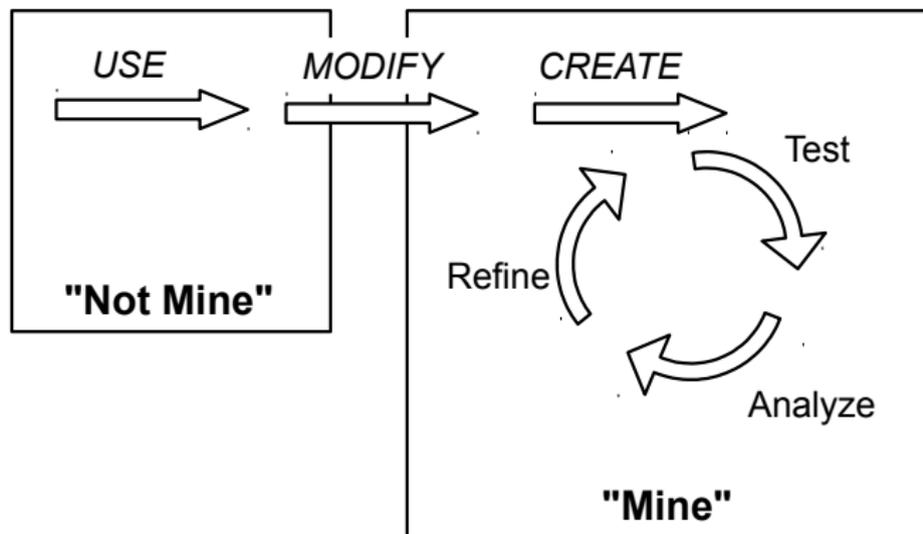
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<sup>1</sup>in fact: Breier (2002)

## Theoretical Context

- ▶ Nine steps of Instructional Design (Gagné)
  - 1965 4. Presenting the content
  - 1974 4. Presenting stimulus material
- ▶ Discovery Learning
- ▶ **Scaffolding** (Vygotsky, Bruner)

Looks familiar, but...<sup>2</sup>



<sup>2</sup>Lee et al. 2011

# Using is motivation.

Never without a context. . .

	A	B	C	D	E	F	G
1	shows		public rehearsal	premiere	2nd show	3rd show	4th show
2	admission fee		£2,00	£5,00	4	4	
3	spectators	teachers	7	10			
4	spectators	students	8	30			
5							
6	earnings		30	200	0		

	A	B	C	D	E	F	G
1	shows		public rehearsal	premiere	2nd show	3rd show	4th show
2	admission fee		£4,00	£10,00	4	4	
3	spectators	teachers	7	10			
4	spectators	students	8	30			
5							
6	earnings		60	200	0		

## Using is motivation.

- Using
- ▶ Use digital systems or haptic manipulatives
  - ▶ Gather experience
  - ▶ Identify limitations and errors

## Using – What do the students get?

- ▶ Suitable contexts
- ▶ Opportunities for operating enactively (if possible)
- ▶ Unfinished or ill-structured, but modifiable digital systems
- ▶ Tasks leading to embedded problems

## 2 Encourage students to analyse.

C2			fx	Σ	=	4
	A	B	C			
1	shows		public rehearsal			
2	admission fee		£4,00			

	A	B	C	D	E	F	G
1	shows		public rehearsal	premiere	2nd show	3rd show	4th show
2	admission fee		£4,00	£10,00		4	4
3	spectators	teachers	7	10			
4	spectators	students	8	30			
5							
6	earnings		=C2*(C3+C4)	200	=E2*(E3+E4)		

## Analysing is constructing knowledge.

- Using
- ▶ Use digital systems or haptic manipulatives
  - ▶ Gather experience
  - ▶ Identify limitations and errors

- Analysing
- ▶ Make assumptions
  - ▶ Examine digital systems
  - ▶ Get insights

## What does students encourage to analyse?

- ▶ Support and slight impulses
- ▶ Opportunities to compare
- ▶ Responding digital systems

### 3 From analysing to creating purposefully.

	A	B	C	D	E	F	G
1	shows		public rehearsal	premiere	2nd show	3rd show	4th show
2	admission fee		£4,00	£10,00	£4,00	£4,00	
3	spectators	teachers	7	10			
4	spectators	students	8	30			
5							
6	earnings		=C2*(C3+C4)	=D2*(D3+D4)	=E2*(E3+E4)	=F2*(F3+F4)	=G2*(G3+G4)

	A	B	C	D	E	F	G
1	shows		public rehearsal	premiere	2nd show	3rd show	4th show
2	admission fee		£4,00	£10,00	£4,00	£4,00	
3	spectators	teachers	7	10			
4	spectators	students	8	30			
5							
6	earnings		=C2*C3+2*C2*C4	=D2*D3+2*D2*D4	=E2*E3+2*E2*E4	=F2*F3+2*F2*F4	=G2*G3+2*G2*G4

## Creating is the first utilisation.

- Using
- ▶ Use digital systems or haptic manipulatives
  - ▶ Gather experience
  - ▶ Identify limitations and errors

- Analysing
- ▶ Make assumptions
  - ▶ Examine digital systems
  - ▶ Get insights

- Creating
- ▶ Correct errors
  - ▶ Enhance digital systems
  - ▶ Transfer knowledge to different contexts

## What makes students create?

- ▶ Imperfection of the material given
- ▶ Open-ended tasks for further development

## Embedding

<b>Researching-Developing Education<sup>3</sup></b>		<b>U-A-C-E</b>
Identifying the problem	Reason for problem Finding the problem Posing the problem	Using Using/Analysing Analysing
Thoughts on problem solving	Analysing the problem Suggestions for solving the problem Decisions for solving the problem	Analysing Creating Creating
Realisation of the solution	Planning specific steps Executing the plan for the solution Reflecting on and summarising the result	Creating Creating <b>Embedding</b>
Abstraction of the results	Iconic abstraction Verbal abstraction Symbolic abstraction	<b>Embedding</b> <b>Embedding</b> <b>Embedding</b>
Consolidating knowledge	Examples (Transfer) Repeating content and methods Examining achievement of learning objectives	<b>Creating/Embedding</b> <b>Embedding</b> <b>Embedding</b>

<sup>3</sup>Schmidkunz/Lindemann (1976)

# What is missing?

Using

Analysing

Creating

**Embedding**

- ▶ Conclusions
- ▶ Making aware learning efforts
- ▶ Bridging the gap – linking new insights to previous knowledge

## 4 Embedding

### Cognitive Operations

- ▶ Verbalise or transfer to a different mode of representation
- ▶ Systemise
- ▶ Transfer to related problems

### Methods

- ▶ ... *current field of research*

# Using – Analysing – Creating – Embedding

## Advantages

- ▶ Practical, discovering approach
- ▶ Focus on student-centered activity
- ▶ Meeting individual needs of the students

## Agenda

- ▶ Student-centered methods for embedding
- ▶ Field studies
- ▶ Application to different contents and objectives

# Discussion

Thank you.

Any questions?