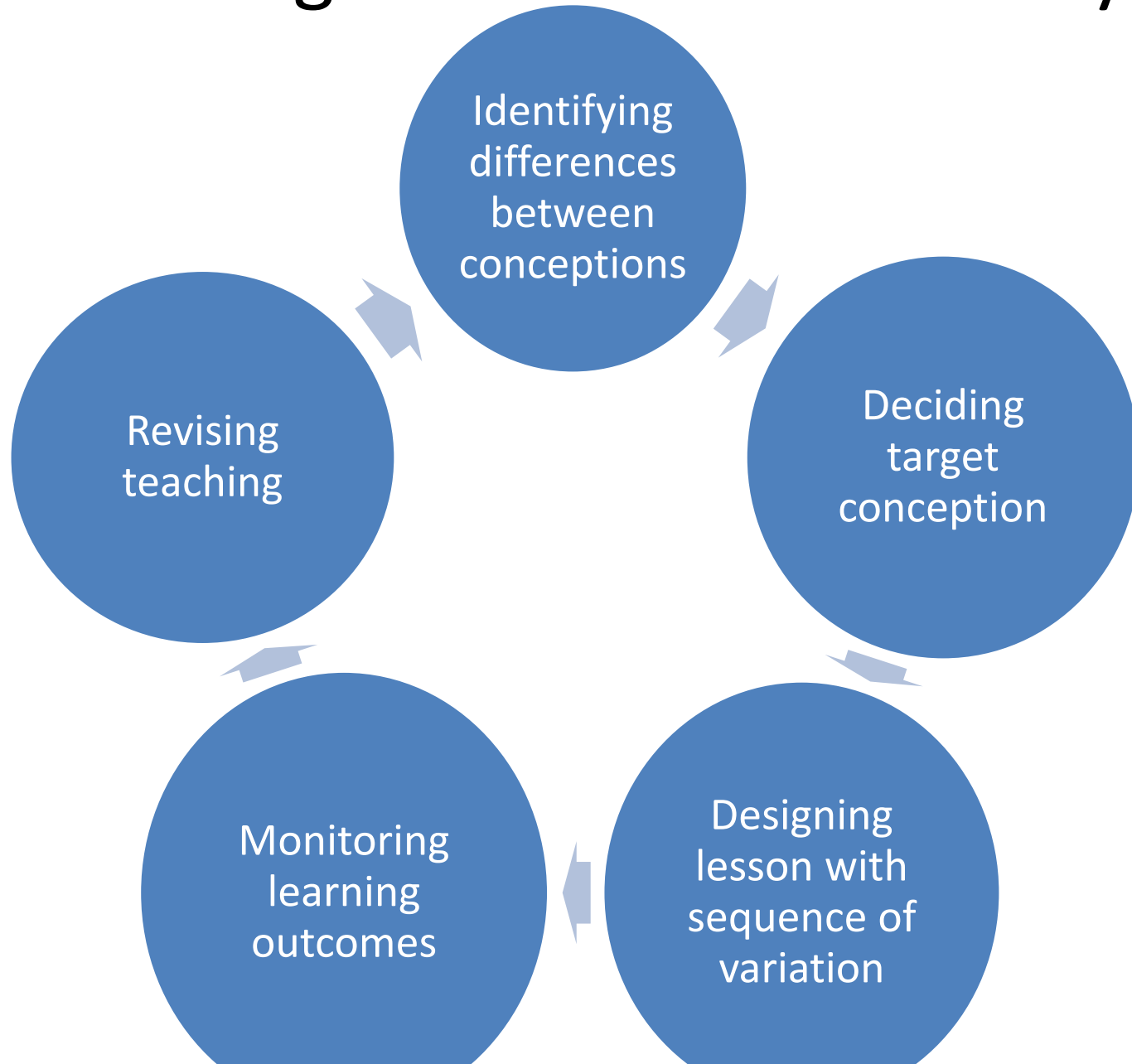# Improving students' conceptions of debt: variation and learner agency
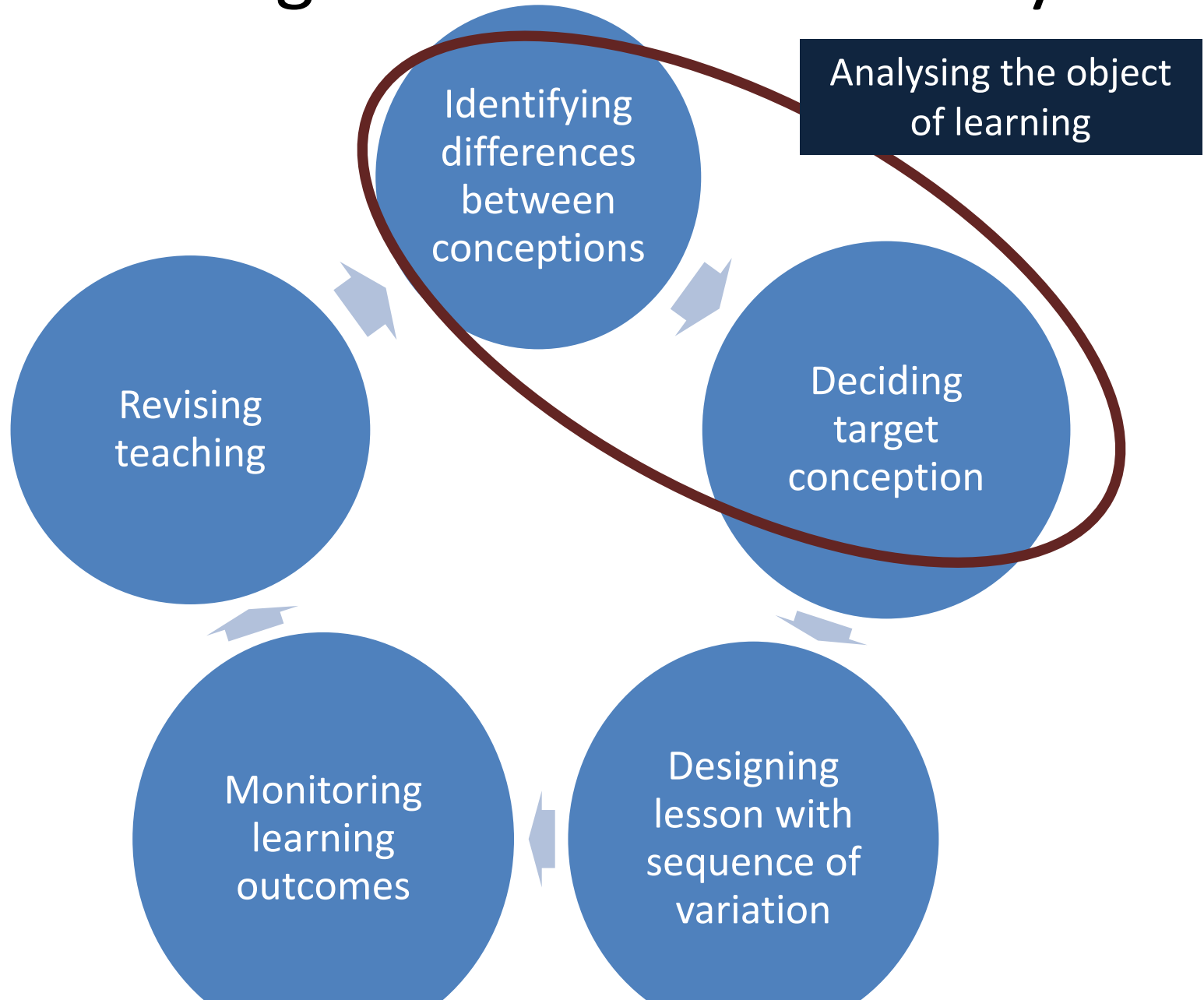
Peter Davies and John Kirkman

School of Education, University of Birmingham, UK

Personal Finance Education Group, May 11th 2016
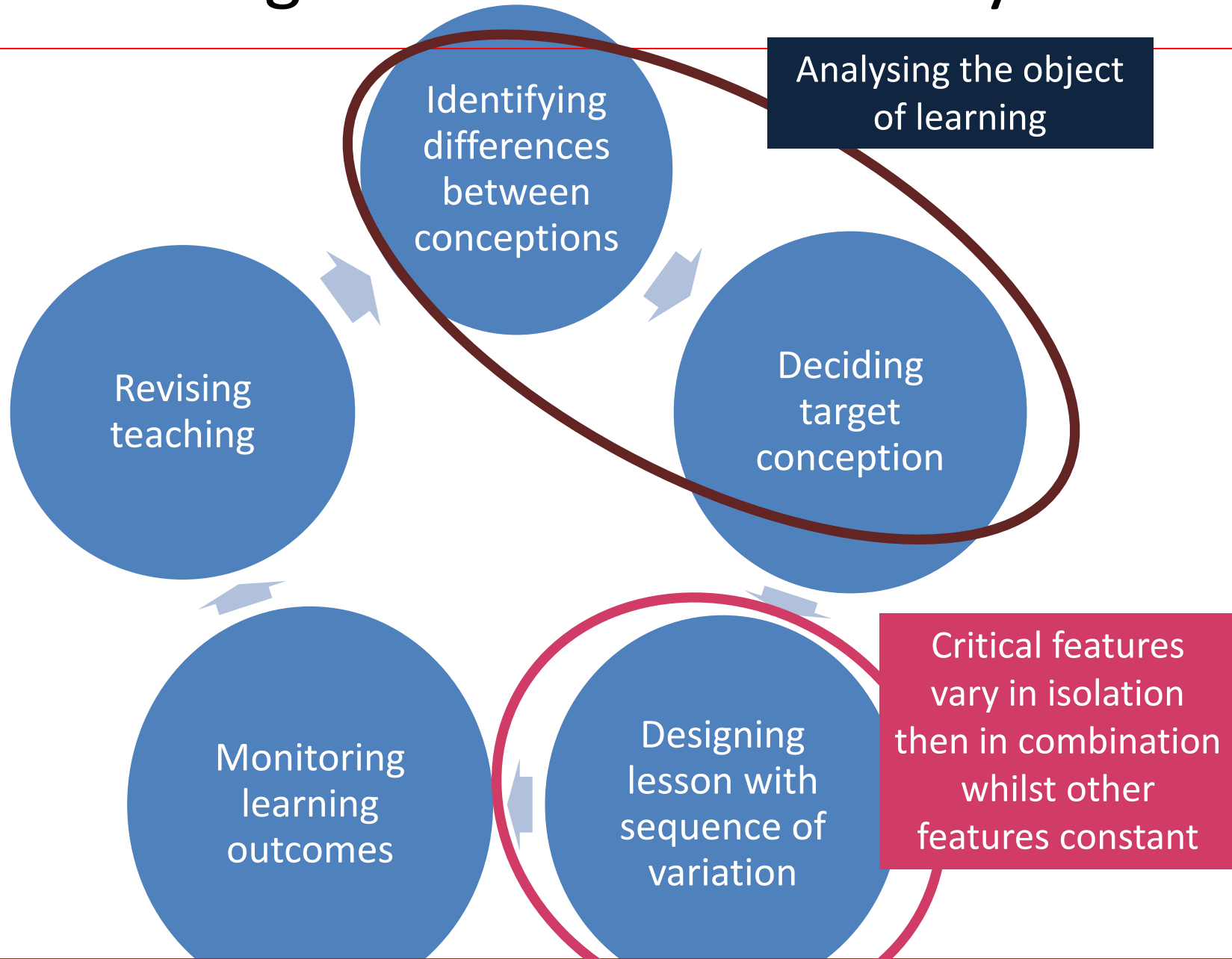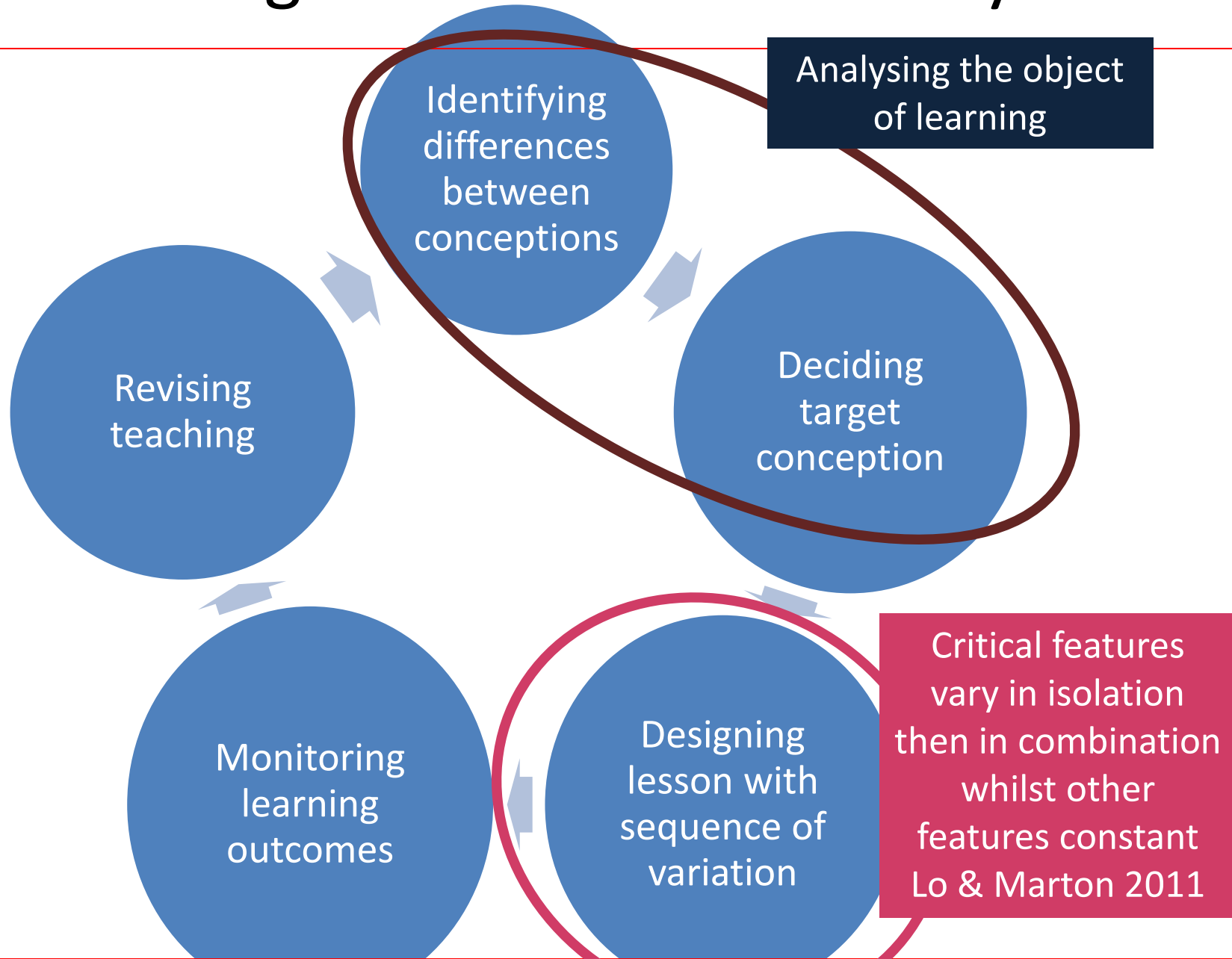
Teaching with Variation Theory

- Identifying differences between conceptions
- Deciding target conception
- Designing lesson with sequence of variation
- Monitoring learning outcomes
- Revising teaching

Teaching with Variation Theory

Teaching with Variation Theory

Identifying differences between conceptions

Analysing the object of learning

Revising teaching

Deciding target conception

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Designing lesson with sequence of variation

Critical features vary in isolation then in combination whilst other features constant

Teaching with Variation Theory

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Critical features vary in isolation then in combination whilst other features constant
Lo & Marton 2011

Teaching with Variation Theory

Identifying differences between conceptions

Analysing the object of learning

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Systematic evidence of association between learning and variation.

Monitoring learning outcomes

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Critical features vary in isolation then in combination whilst other features constant
Lo & Marton 2011

What about a role for the agency of the learner?

Can learners take on some of the roles of the teacher? (Palincsar & Brown 1984)

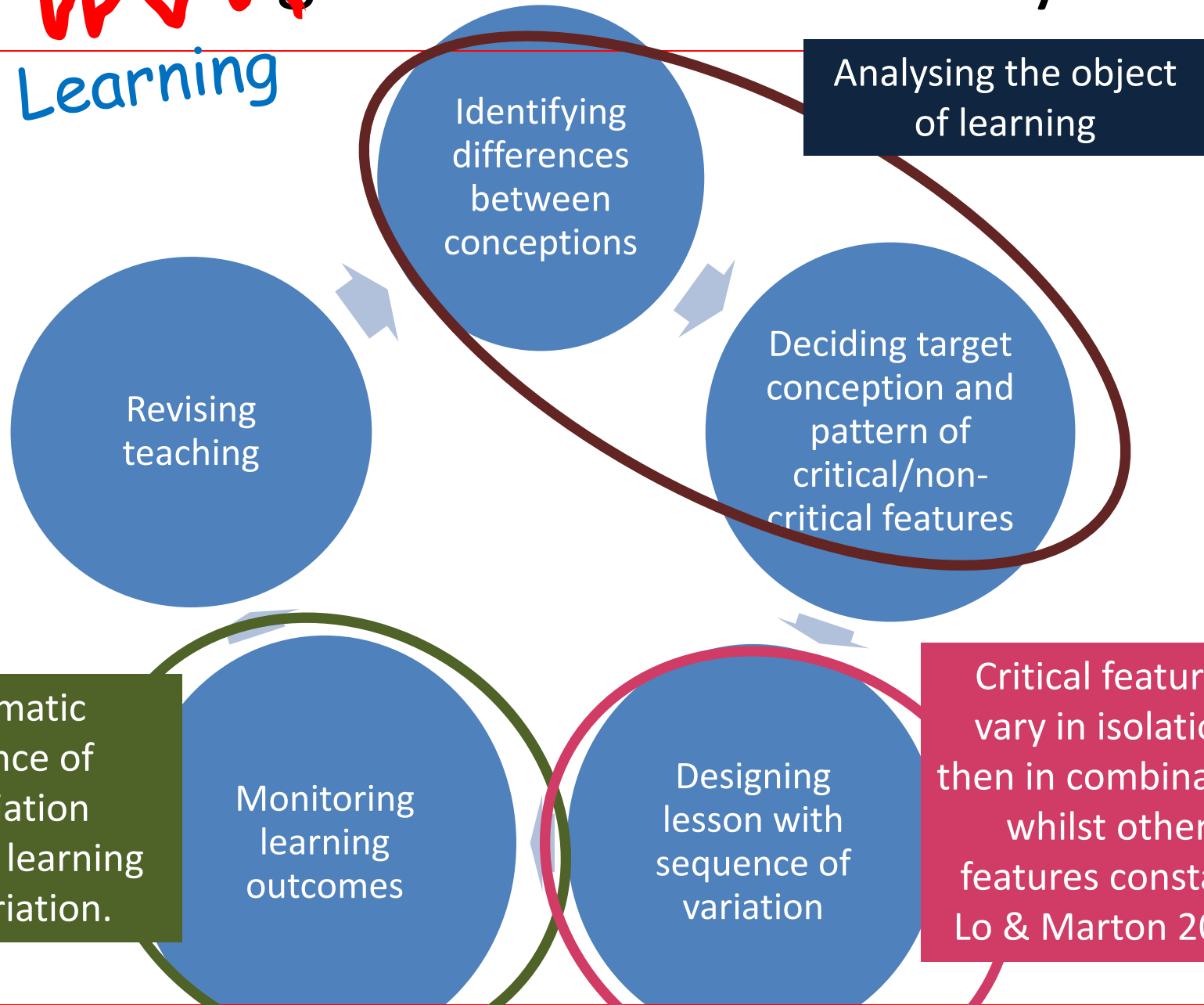# What about a role for the agency of the learner?

Can learners take on some of the roles of the teacher? (Palincsar & Brown 1984)

But the role for the teacher depends on the theory of learning guiding the teacher's practice…

What about a role for the agency of the learner?

Can learners take on some of the roles of the teacher? (Palincsar & Brown 1984)

But the role for the teacher depends on the theory of learning guiding the teacher's practice…

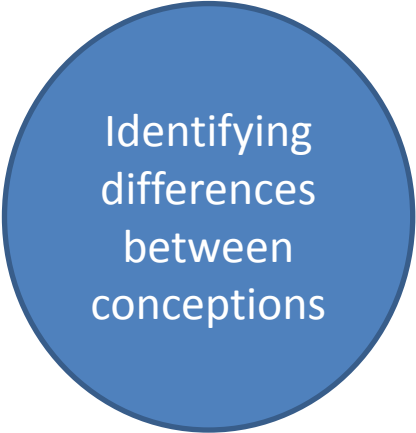Which takes us to the sequence of roles/tasks for the teacher suggested by Variation Theory…

Teaching with Variation Theory

Learning

Identifying differences between conceptions

Analysing the object of learning

Revising teaching

Deciding target conception and pattern of critical/non-critical features

Systematic evidence of association between learning and variation.

Monitoring learning outcomes

Designing lesson with sequence of variation

Critical features vary in isolation then in combination whilst other features constant Lo & Marton 2011

Teaching with Variation Theory

Learning

Identifying differences between conceptions

Teaching with Variation Theory

Learning

Are these ideas about the price of a burger the same or different?

Identifying differences between conceptions

The price went up because they added ketchup

The price went up because staff wages went up

The price went up because you can now tell it's got beef in it

Teaching with Variation Theory

Learning

Are these ideas about the price of a burger the same or different?

Identifying differences between conceptions

The price went up because they added ketchup

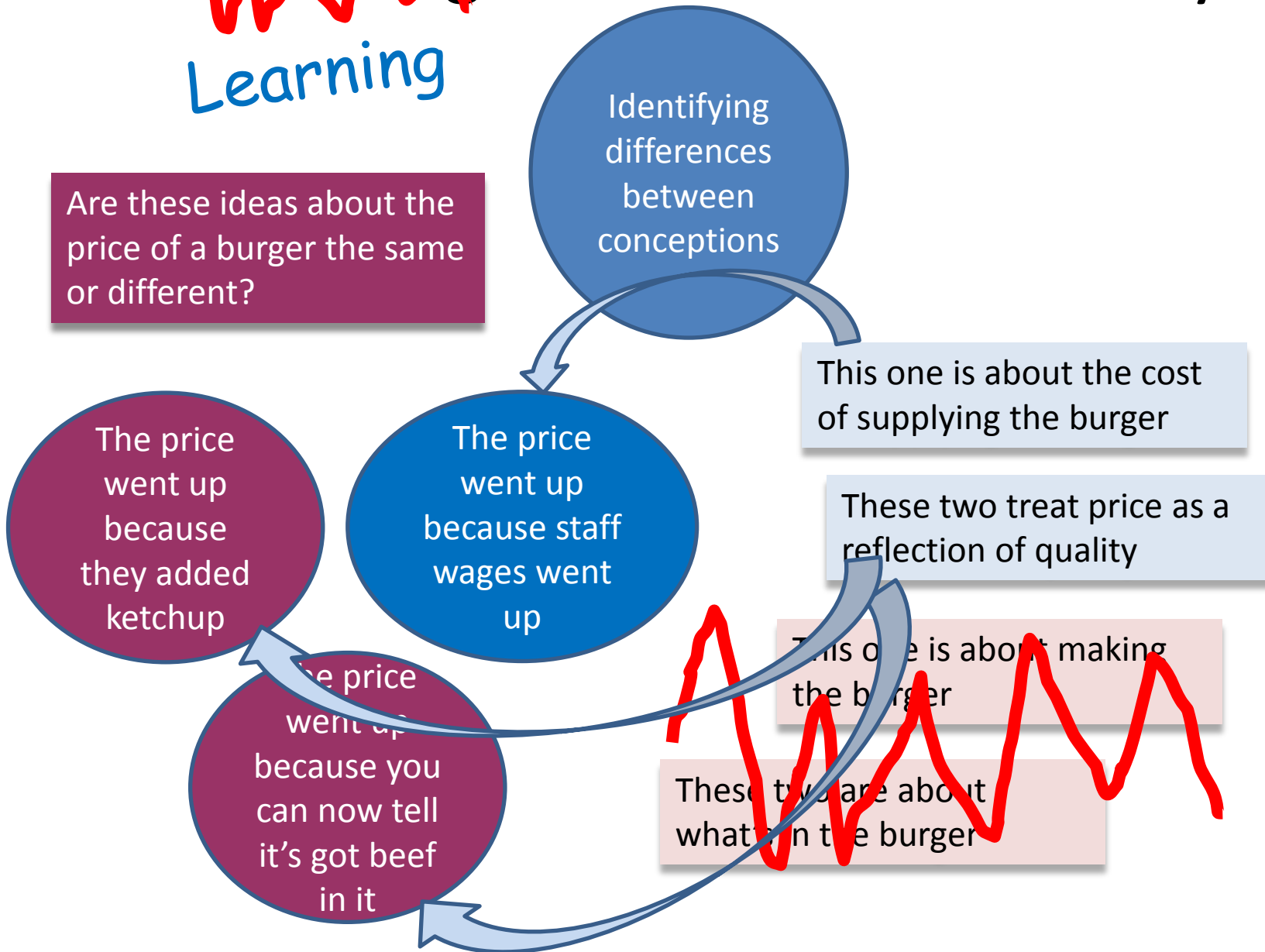The price went up because staff wages went up

The price went up because you can now tell it's got beef in it

Teaching with Variation Theory

Learning

Identifying differences between conceptions

Are these ideas about the price of a burger the same or different?

The price went up because they added ketchup

The price went up because staff wages went up

The price went up because you can now tell it's got beef in it

This one is about making the burger

These two are about what's in the burger

Teaching with Variation Theory

Learning

Identifying differences between conceptions

Are these ideas about the price of a burger the same or different?

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Teaching with Variation Theory

Learning

Identifying differences between conceptions

Are these ideas about the price of a burger the same or different?

The price went up because they added ketchup

The price went up because staff wages went up

The price went up because you can now tell it's got beef in it

This one is about the cost of supplying the burger

These two treat price as a reflection of quality

This one is about making the burger

These two are about what's in the burger

# Teaching with Variation Theory

Learning

Identifying differences between conceptions

Students could be asked to assess whether answers to a problem given by peers using an established categorisation
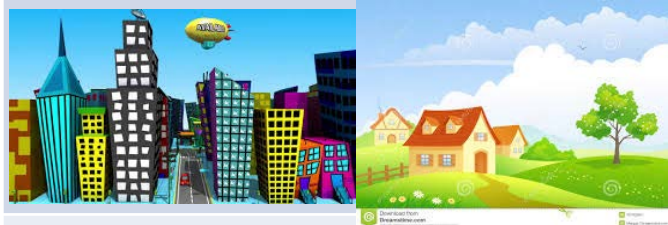
	Category	Example
1	Price depends on the quality of the product	'The price of the burger went up because they added ketchup'
2	Price depends on how much it costs to supply the product	'The price of the burger went up because staff wages went up'

Teaching with Variation Theory

Learning

Identifying differences between conceptions

Students could be asked to assess whether answers to a problem given by peers using an established categorisation

Monitoring learning outcomes

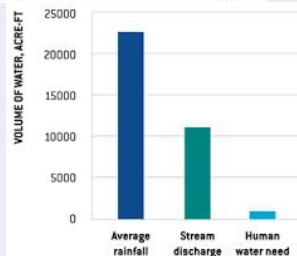# 12-14 year-old students monitoring understanding of descriptions in Geography (Davies et al 2004)
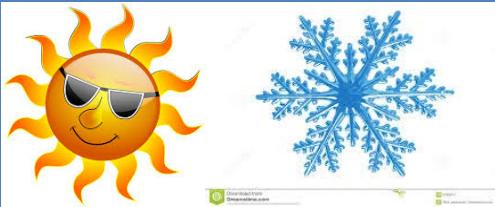
Extremes	Using accurate place names to identify locations and using extremes like hard/soft; hilly/flat; wet/dry; rich/poor to describe features and places
Different Types	Recognizing different types of place using words like warm; cool; freezing; and very hot as well as hot and cold; using terms like semi-detached; detached; terraced; and flats to describe different dwellings
Comparisons	Using numbers to compare features (e.g. twice as many people; half the range of temperature) and places and describing the differences *within* places
Ratios and Patterns	Grouping descriptions to give a sense of a whole place and using terms that combine ideas like population density; converge and diverge; and humidity to describe features and places
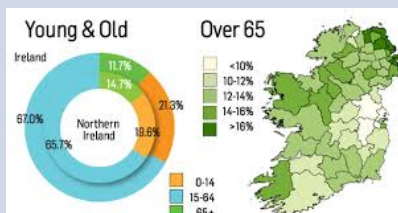
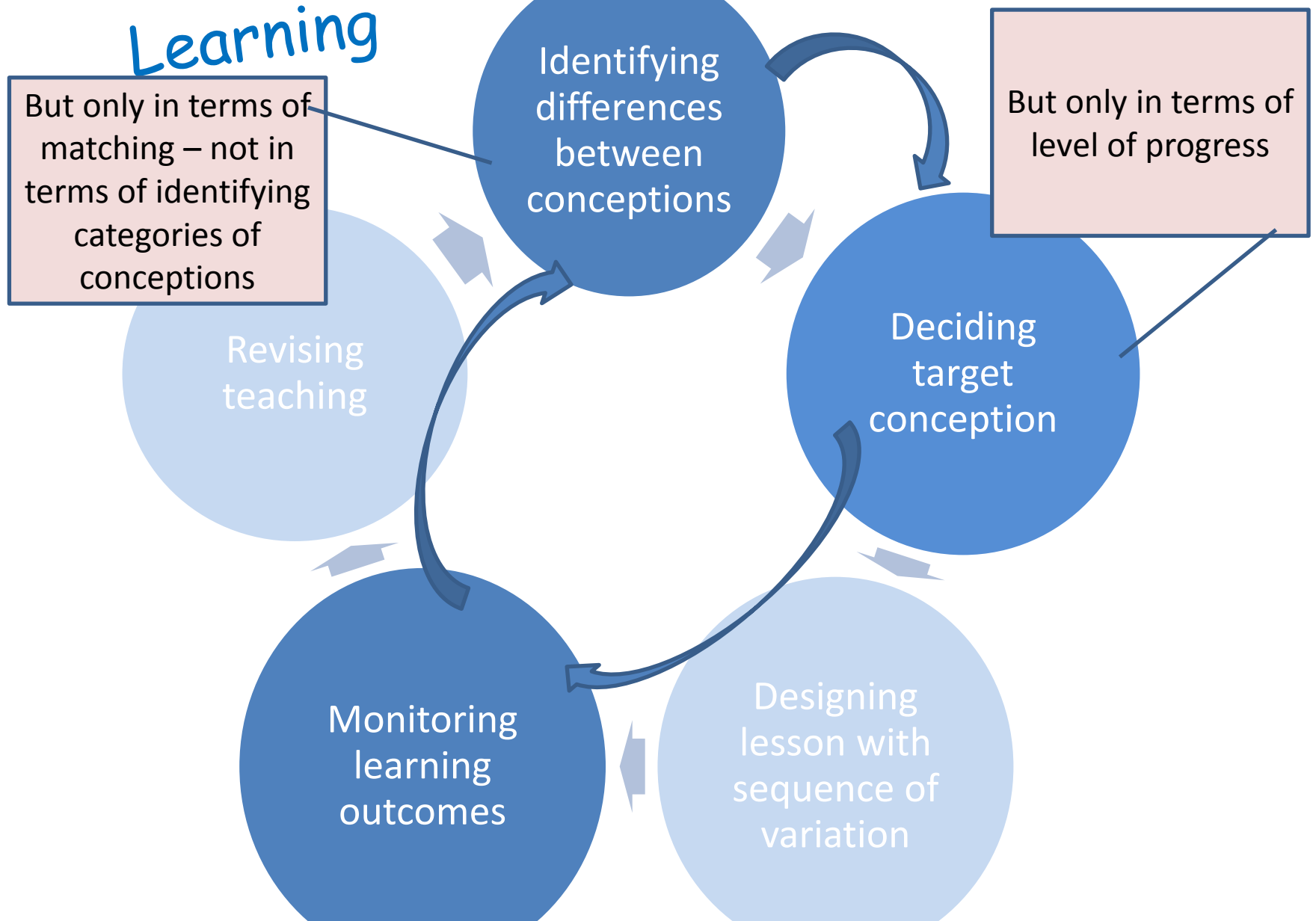# An example of a student's evaluation of the quality of their writing

Claire selected from her writing

"In the centre of England they have the average amount of rain. The range of the rainfall in England is 600 to 2400mm. In conclusion, the West have at least twice as much than the east."

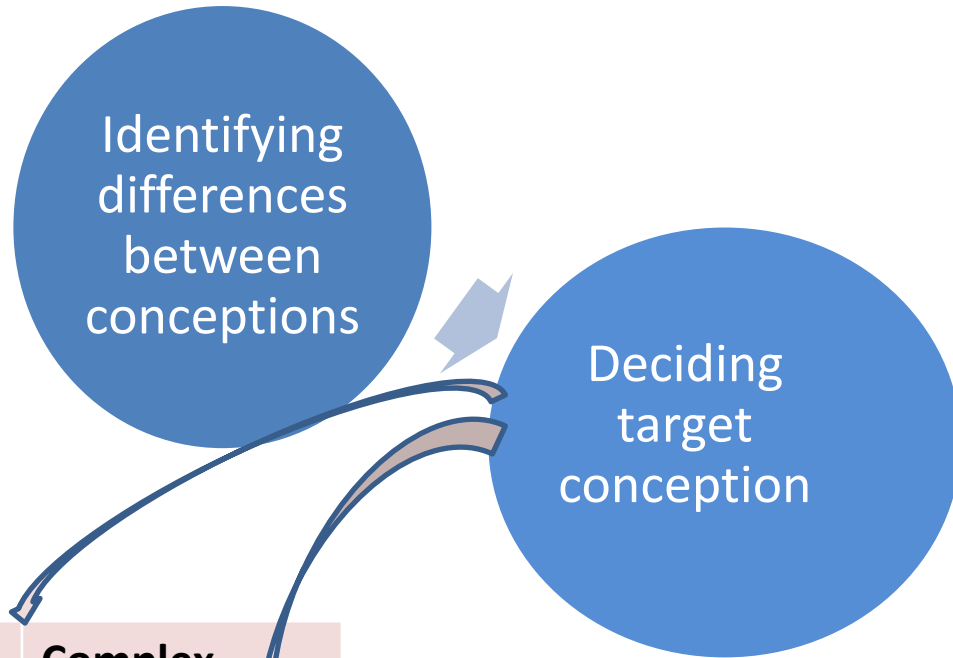She argued that this piece of writing was good because 'it includes the range, numbers, average and a conclusion'.

Teaching with Variation Theory

Learning

Identifying differences between conceptions

Deciding target conception

Designing lesson with sequence of variation

Monitoring learning outcomes

Revising teaching

But only in terms of matching – not in terms of identifying categories of conceptions

But only in terms of level of progress

Teaching with Variation Theory

Learning

Identifying differences between conceptions

Deciding target conception

Hierarchy	Simple	Complex	
Rationale	Curriculum/ Standards driven	Student interest driven	Desired Society driven

Teaching with Variation Theory
Learning
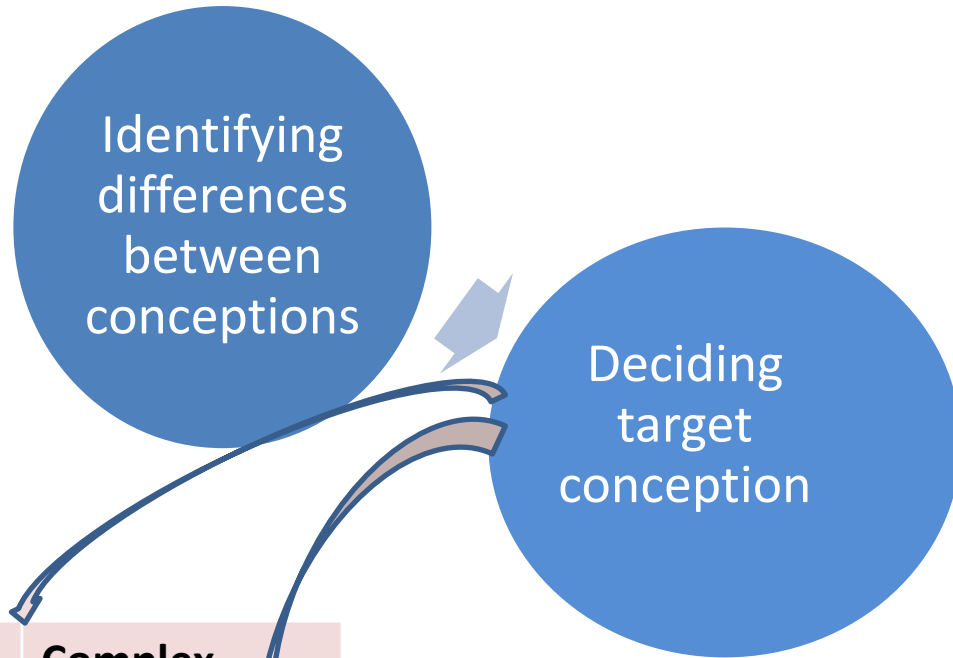
Identifying differences between conceptions

Deciding target conception

Hierarchy	Simple	Complex	
Rationale	Curriculum/ Standards driven	Student interest driven	Desired Society driven

14-17 year-old students' understanding of debt: dimensions of variation suggested by interviews ('good or bad debt?')

Reasoning about different forms of debt (including different forms of personal debt and government debt vs reasoning about personal debt – same or different?

Reasoning about asset values over time.

Reasoning about the relationship between interest payments and debt

Reasoning about the relationship between inflation and debt

Reasoning about ability to repay debt

Reasoning about repayment period

14-17 year-old students' understanding of debt: dimensions of variation suggested by interviews ('good or bad debt?')

14-17 year-old students' understanding of debt: dimensions of variation suggested by interviews ('good or bad debt?')

Giving 14-15 year-old students a role in choosing their learning objective(s) in the context of learning about debt:
'Choose between 3 and 5 of following and use the lesson to improve your understanding of how they are related. '

risk

The size of the debt

Length of repayment period

Enjoyment from whatever is bought

Real and money values

Future income

Interest payments

Value of any assets bought

Debt repayments
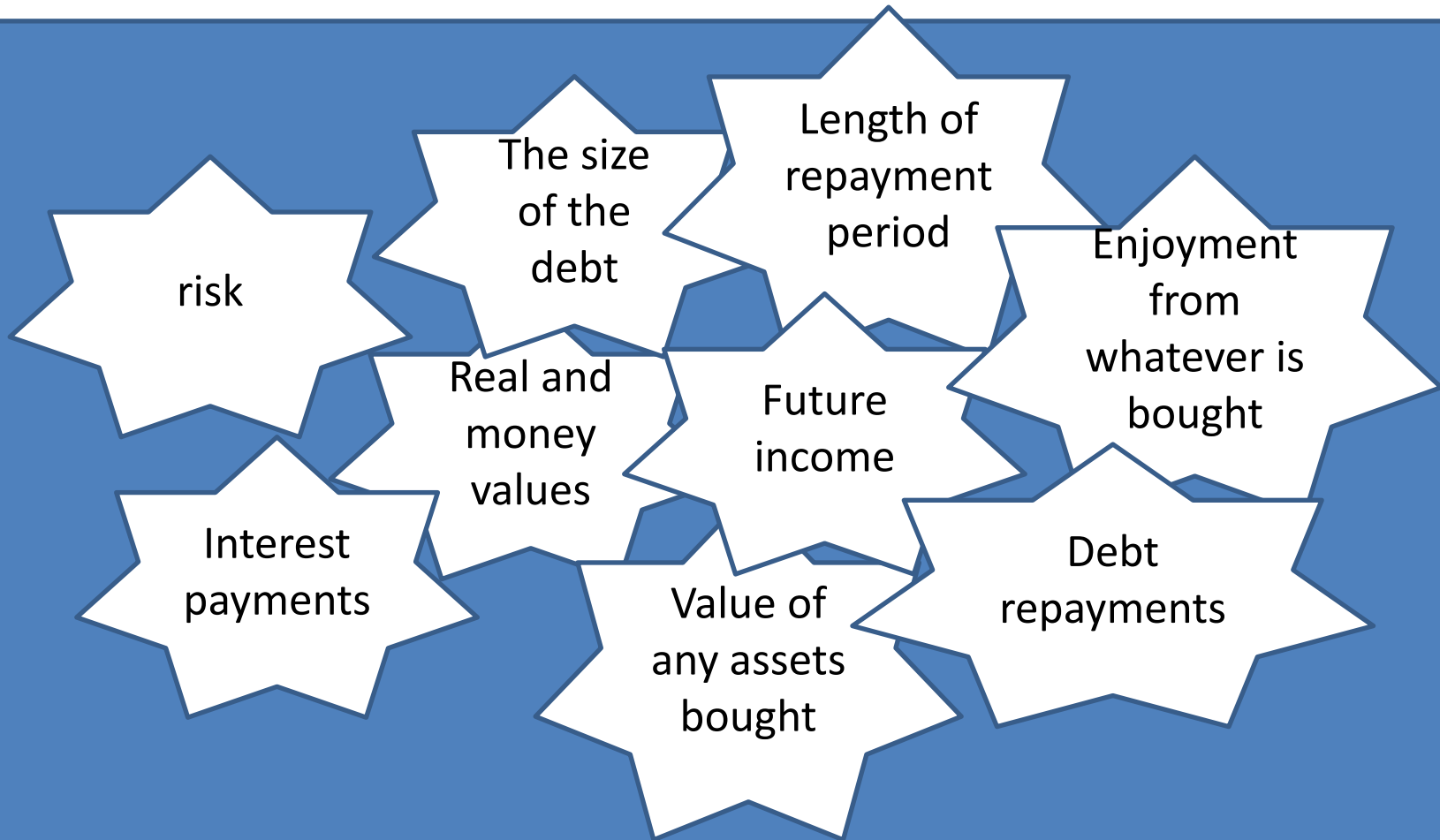
Students chose combinations of factors which they DID NOT refer to when answering a baselining problem
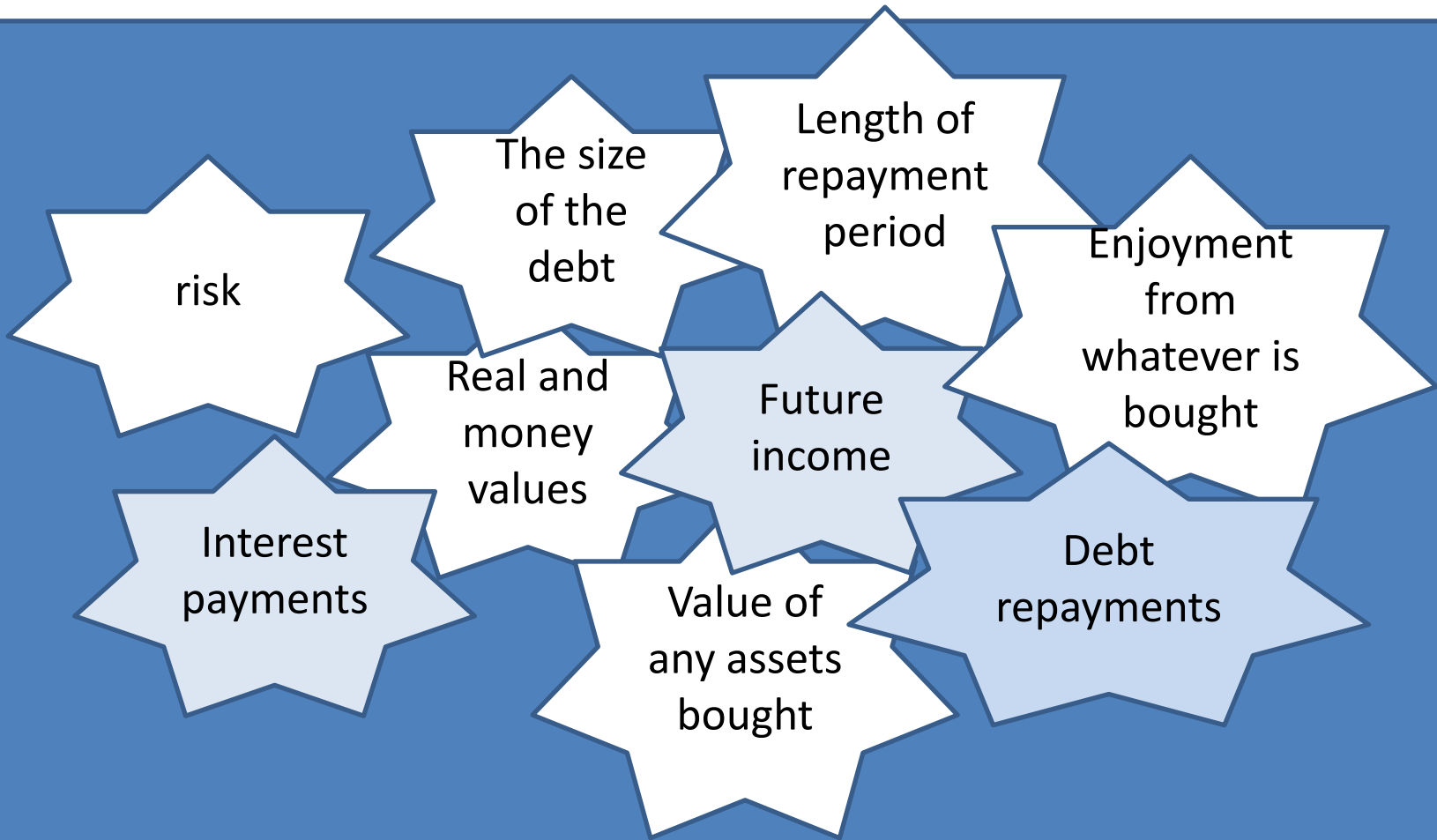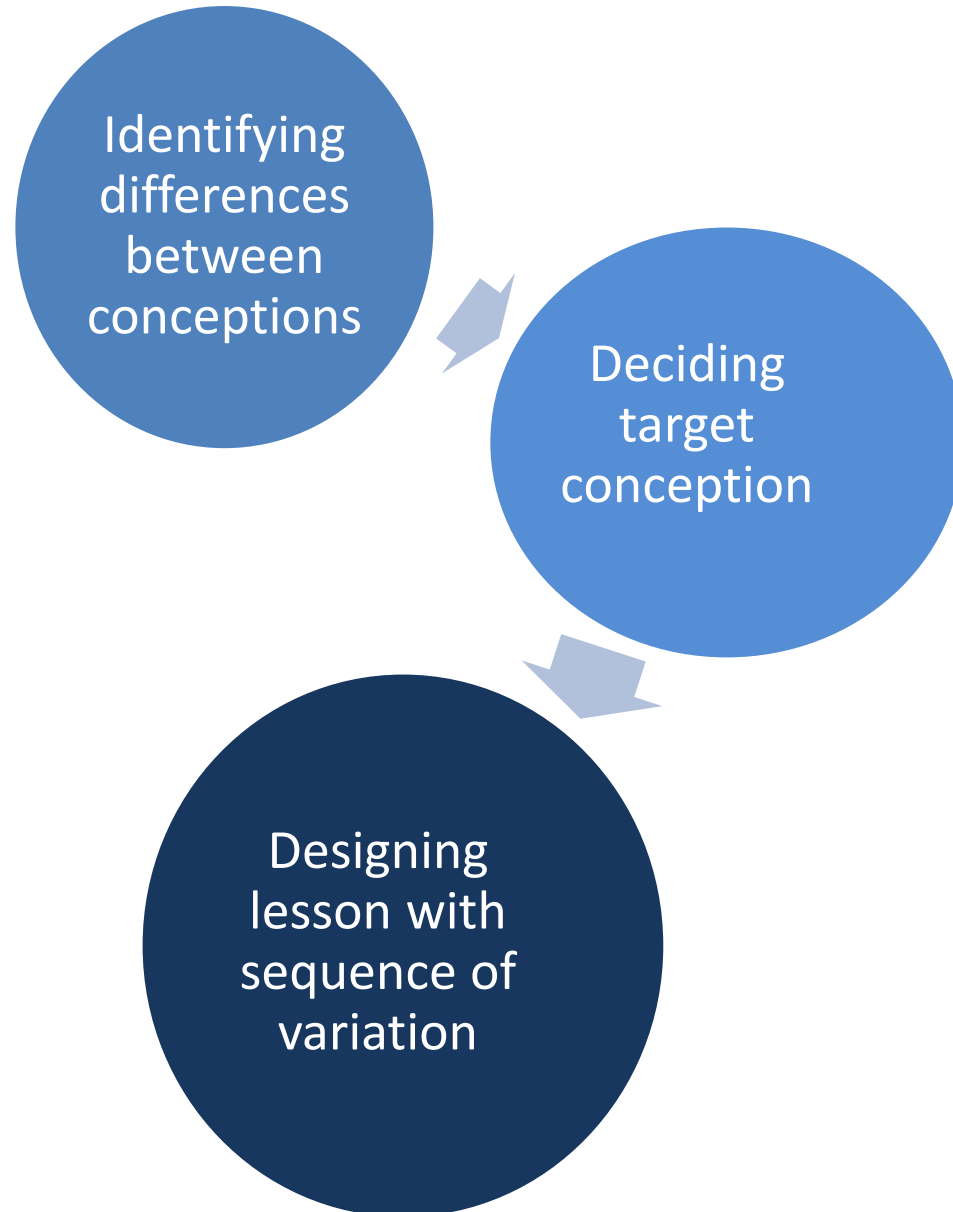
risk

The size of the debt

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Real and money values

Future income

Interest payments

Value of any assets bought

Debt repayments

Teaching with Variation Theory

Learning

Identifying differences between conceptions

Deciding target conception

Designing lesson with sequence of variation

Set a problem for another group

Factor chosen in learning objective (e.g. Future income)		
Low	Medium	High
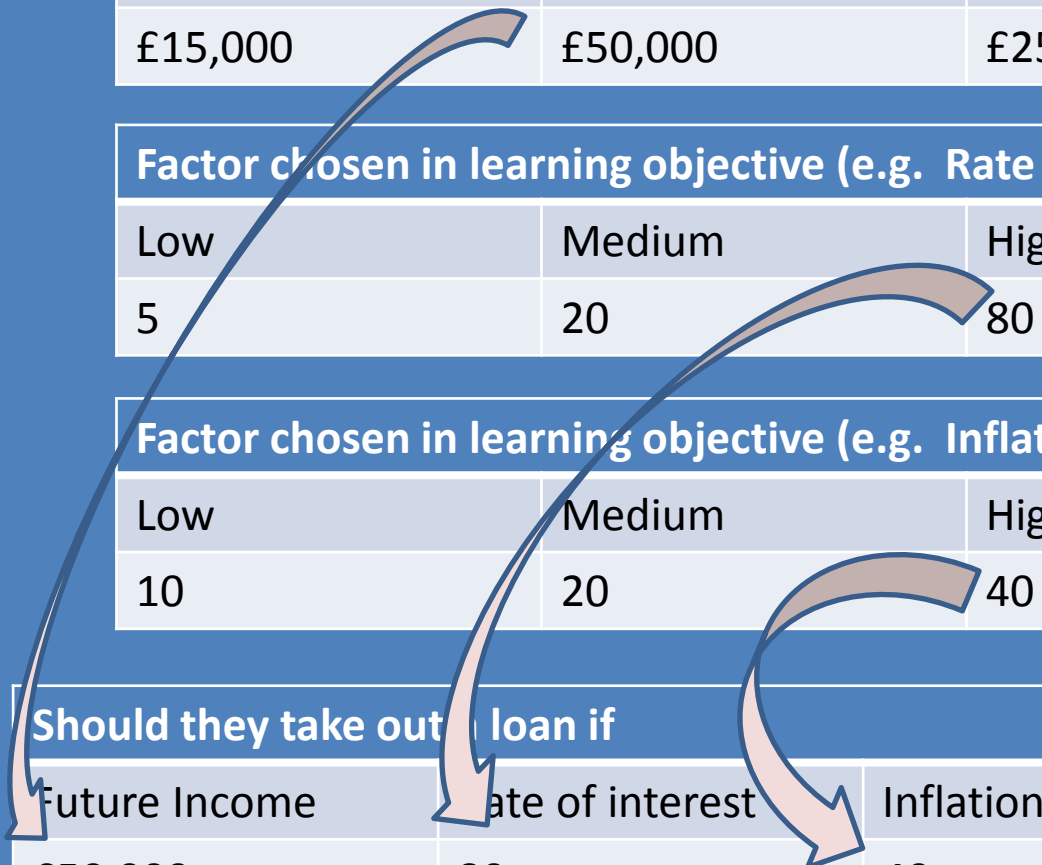
Set a problem for another group

Factor chosen in learning objective (e.g. Future income)		
Low	Medium	High
£15,000	£50,000	£250,000

Factor chosen in learning objective (e.g. Rate of interest)		
Low	Medium	High
5	20	80

Factor chosen in learning objective (e.g. Inflation)		
Low	Medium	High
10	20	40

Should they take out a loan if		
Future Income	Rate of interest	Inflation
£50,000	80	40

Set a problem for another group

Factor chosen in learning objective (e.g. Future income)		
	Medium	High
...000	£50,000	£250,000

...or chosen in learning objective (e.g. Rate of interest)		
	Medium	High
	20	80

...or chosen in learning objective (e.g. Inflation)		
	Medium	High
10	20	40

Problem 1: Students tended to have very unrealistic ideas about sensible values for averages and variations around the average.

Should they take out a loan if		
Future Income	Rate of interest	Inflation
£50,000	80	40

Set a problem for another group

Factor chosen in learning objective (e.g. Future income)		
	Medium	High
...000	£50,000	£250,000

...or chosen in learning objective (e.g. Rate of interest)		
	Medium	High
	20	80

...or chosen in learning objective (e.g. Inflation)		
	Medium	High
10	20	40

Should they take out a loan if		
Future Income	...ate of interest	Inflation
£50,000	80	40

Problem 1: Students tended to have very unrealistic ideas about sensible values for averages and variations around the average.

Problem 2: Students were given no help with variation in the relation between the factor and debt repayments
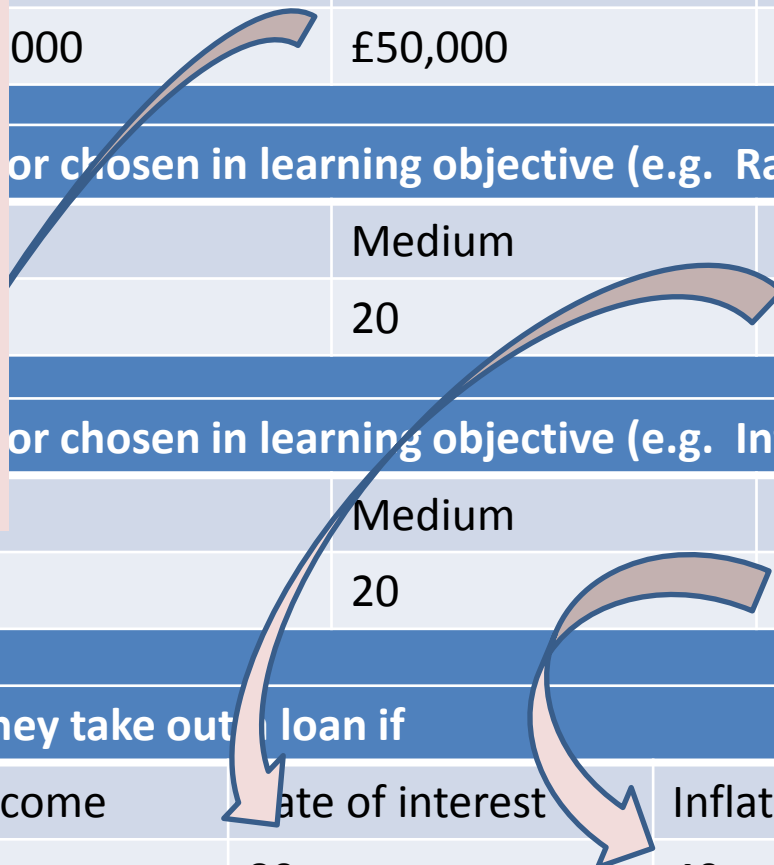
Revised Task

A 25 year-old is planning to take a loan to buy a car

Monthly Income	850
Size of Loan	800
Years to repay	2
Annual change in car value	-8
Interest rate	3
Inflation rate	2

With each cell the students have a range of realistic options they can choose between

Revised Task

A 25 year-old is planning to take a loan to buy a car

Monthly Income	850
Size of Loan	800
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Annual change in car value	-8
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With each cell the students have a range of realistic options they can choose between

Monthly repayment	
% of monthly income	
Total amount to repay	

Revised Task using a spreadsheet

A 25 year-old is planning to take a loan to buy a car

Monthly Income	850
Size of Loan	8000
Years to repay	2
Annual change in car value	-8
Interest rate	3
Inflation rate	2

Monthly repayment	344
% of monthly income	40%
Total amount to repay	8252

Year	Out-standing debt end of year	Asset value	Net of asset value and loan	Real net value of asset and loan
1	-4126	7360	-892	-875
2		6771	-1481	-1424
3		6230	-2023	-1906
4		5731	-2521	-2329
5		5273	-2980	-2699

Teaching with Variation Theory

Learning

A quick summary

	In these examples
Asking students to identify categorical differences between conceptions (and critical features)?	Does not look feasible
Asking students to match conceptions with categories and to review their own learning with such categories	Feasible and promising
asking students to contribute in setting their own learning objectives in terms of focus as well as rate of progress	Feasible
Asking students to create patterns of variation	Does not look feasible
Giving students some control over the pattern of variation in critical features	Looks feasible

Teaching with Variation Theory

Learning

Thank you

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