Improving the quality of learning in a blended learning environment for first-year biology

Angelique Kritzinger, JuanClaude Lemmens
Marietjie Potgieter
University of Pretoria, South Africa
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Make today matter

Layout

- Introduction
- Context of the research
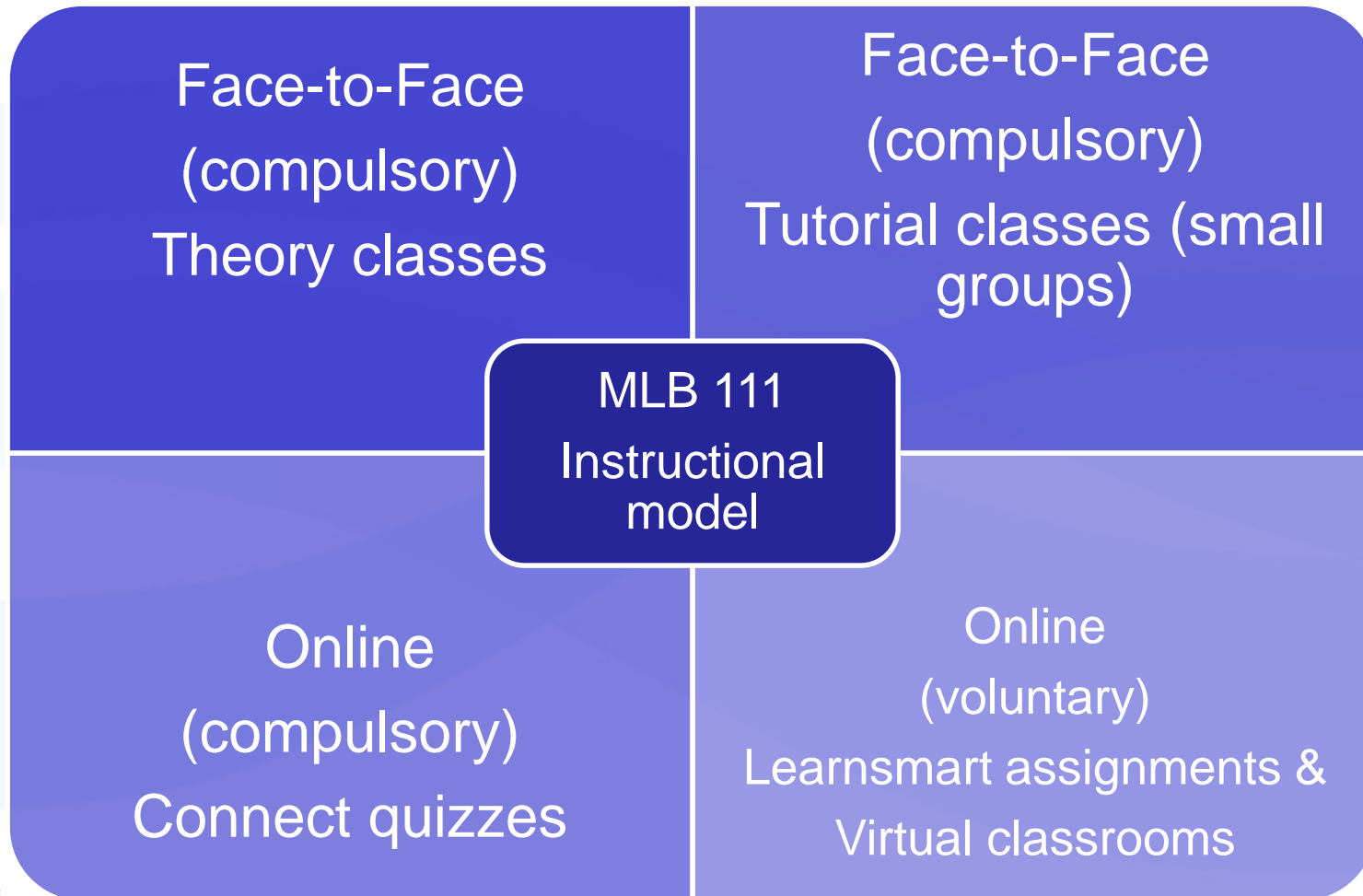- Conceptual framework
- Data
- Results
- Conclusion

Introduction

The 21C Teacher

Aim

To assess the effectiveness and efficiency of a large, first year biology blended learning course

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Active learning

Time on task

Prompt feedback

Effectiveness & Efficiency

High expectations

Collaborative learning

Diverse learners

Student /lecturer contact

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Chickering and Gamson, 1987

Context: MLB 111

Face-to-Face (compulsory)
Theory classes

Face-to-Face (compulsory)
Tutorial classes (small groups)

MLB 111 Instructional model

Online (compulsory)
Connect quizzes

Online (voluntary)
Learnsmart assignments &
Virtual classrooms

Contact between students & lecturers
Reciprocity and cooperation among students
Active learning
Communication of high expectations

Timely feedback

Time-on-task

Diverse talents and ways of learning

Contact between students and lecturers

Diverse talents and ways of learning

Active learning

Conceptual framework

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Research questions

To assess the effectiveness of the blend of learning opportunities

RQ1: What are the differences in the uptake of learning opportunities by the likely-to-pass (LTP), murky middle (MM) and at-risk groups of students?

RQ2: Which of the activities in the blended learning environment are associated most strongly with success for the MM?

Methodology

Demographic and prior learning data

Use data to divide cohort into three groups

Engagement data

Research question 1

Use all engagement data to describe patterns of engagement with learning opportunities and their contribution to success

Engagement data with MM fail and MM pass

Research question 2

Use engagement data for MM group to determine engagement patterns that are more productive for this group

Period 1 (Before semester test 1)

Tutorials – 7   Learnsmart – 5

Connect tests – 4   Virtual Tutorial – 9

Class participation – 10

Period 2 (Between semester test 1 and 2)

Tutorials – 3   Learnsmart – 3

Connect tests – 3   Virtual Tutorial – 5

Class participation – 8

Period 3 (Between semester test 2 and final examination

Tutorials – 1   Learnsmart – 2

Connect tests – 1   Virtual Tutorial – 5

Class participation – 5

		Activities before semester test 1 (period 1)					Activities between semester test 1 and 2 (period 2)				
Compulsory activities											
Voluntary activities											

		Activities before semester test 1 (period 1)					Activities between semester test 1 and 2 (period 2)				
		At-risk (1)	MM (2)	Likely-to-pass (3)	*p*-value	Eta squared	At-risk (1)	MM (2)	Likely-to-pass (3)	*p*-value	Eta squared
Compulsory activities	Peer led tutorial classes Average %										
	Connect Online quiz Average %										
	Participation in class total count										
Voluntary activities	Learnsmart Average %										
	Virtual classrooms total count										

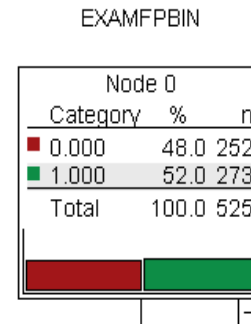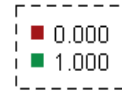|	Activities before semester test 1 (period 1)					Activities between semester test 1 and 2 (period 2)				
	At-risk (1)	MM (2)	Likely-to-pass (3)	*p*-value	Eta squared	At-risk (1)	MM (2)	Likely-to-pass (3)	*p*-value	Eta squared
Compulsory activities — **Peer led tutorial classes Average %**	77%	81%	88%	$p_{(1/2)}<0.001$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.001$	0.070	71%	74%	80%	$p_{(1/2)}=0.120$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.001$	0.04
Connect Online quiz Average %				$p_{(1/2)}<0.001$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.001$	0.087				$p_{(1/2)}=0.015$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.001$	0.086
Participation in class total count				$p_{(1/2)}=0.007$ $p_{(1/3)}<0.001$ $p_{(2/3)}=0.072$	0.027				$p_{(1/2)}=0.037$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.002$	0.035
Voluntary activities — **Learnsmart Average %**				$p_{(1/2)}<0.001$ $p_{(1/3)}<0.001$ $p_{(2/3)}=0.277$	0.031				$p_{(1/2)}=0.012$ $p_{(1/3)}=0.005$ $p_{(2/3)}=0.974$	0.012
Virtual classrooms total count				$p_{(1/2)}=0.068$ $p_{(1/3)}=0.933$ $p_{(2/3)}=0.019$	0.037				$p_{(1/2)}=0.401$ $p_{(1/3)}=0.576$ $p_{(2/3)}=0.952$	0.002

	Activities before semester test 1 (period 1)		Activities between semester test 1 and 2 (period 2)	
	Period 1		**Period 2**	
	p-value	Eta squared	p-value	Eta squared
Peer led tutorial classes	$p_{(1/2)}<0.001$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.001$	0.070	$p_{(1/2)}=0.120$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.001$	0.04
Average %			$p_{(2/3)}<0.001$			$p_{(2/3)}<0.001$	
Participation in class total count			$p_{(1/2)}=0.007$ $p_{(1/3)}<0.001$ $p_{(2/3)}=0.072$	0.027			$p_{(1/2)}=0.037$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.002$	0.035
Learnsmart Average %			$p_{(1/2)}<0.001$ $p_{(1/3)}<0.001$ $p_{(2/3)}=0.277$	0.031			$p_{(1/2)}=0.012$ $p_{(1/3)}=0.005$ $p_{(2/3)}=0.974$	0.012
Virtual classrooms total count			$p_{(1/2)}=0.068$ $p_{(1/3)}=0.933$ $p_{(2/3)}=0.019$	0.037			$p_{(1/2)}=0.401$ $p_{(1/3)}=0.576$ $p_{(2/3)}=0.952$	0.002

Compulsory activities

Voluntary activities

15

	Activities before semester test 1 (period 1)	Activities between semester test 1 and 2 (period 2)

	Period 1		Period 2	
	p-value	Eta squared	p-value	Eta squared
Participation in class total count	$p_{(1/2)}<0.001$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.072$	0.027	$p_{(1/2)}=0.037$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.002$	0.035

Compulsory activities

		Period 1			Period 2	
Average %			$p_{(1/3)}<0.001$ $p_{(2/3)}<0.001$			$p_{(1/3)}<0.001$ $p_{(2/3)}<0.001$
Participation in class total count			$p_{(1/2)}=0.007$ $p_{(1/3)}<0.001$ $p_{(2/3)}=0.072$	0.027		$p_{(1/2)}=0.037$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.002$	0.035

Voluntary activities

Learnsmart Average %			$p_{(1/2)}<0.001$ $p_{(1/3)}<0.001$ $p_{(2/3)}=0.277$	0.031		$p_{(1/2)}=0.012$ $p_{(1/3)}=0.005$ $p_{(2/3)}=0.974$	0.012
Virtual classrooms total count			$p_{(1/2)}=0.068$ $p_{(1/3)}=0.933$ $p_{(2/3)}=0.019$	0.037		$p_{(1/2)}=0.401$ $p_{(1/3)}=0.576$ $p_{(2/3)}=0.952$	0.002

Module pass rate: 80%

Exam pass rate: 52%
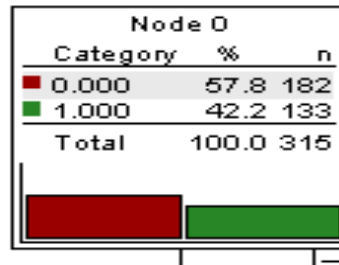
EXAMFPBIN

Node 0		
Category	%	n
■ 0.000	48.0	252
■ 1.000	52.0	273
Total	100.0	525

■ 0.000
■ 1.000

Power of Prediction 76%

ST1 Fail Pass BIN

Node 0		
Category	%	n
■ 0.000	57.8	182
■ 1.000	42.2	133
Total	100.0	315

■ 0.000
■ 1.000

MM with first summative assessment

Power of prediction 73%

		Activities before semester test 1 (period 1)				Activities between semester test 1 and 2 (period 2)			
		MM fail exam	MM pass exam	p-value	Eta squared	MM fail exam	MM pass exam	p-value	Eta squared
Compulsory activities	Peer led tutorial classes (Average %)	80%	87%	0.001	0.145	75%	77%	0.144	0.007
	Connect Online quiz (Average %)	67%	79%	0.001	0.058	76%	62%	0.001	0.043
	Participation in class (total count)	8.7	9.2	0.001	0.024	6.7	7.1	0.10	0.022
Voluntary activities	Learnsmart (Average %)	19%	35%	0.007	0.056	9%	17%	0.004	0.027
	Virtual classrooms (total count)	3.0	2.5	0.340	0.016	0.26	0.33	0.431	0.002

Conclusion

- Small face-to-face classes and regular online quizzes contribute most to success

- Limited meaningful engagement with optional activities

- Motivation to keep up with work

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Conclusion

- Efficient courses to avoid overload
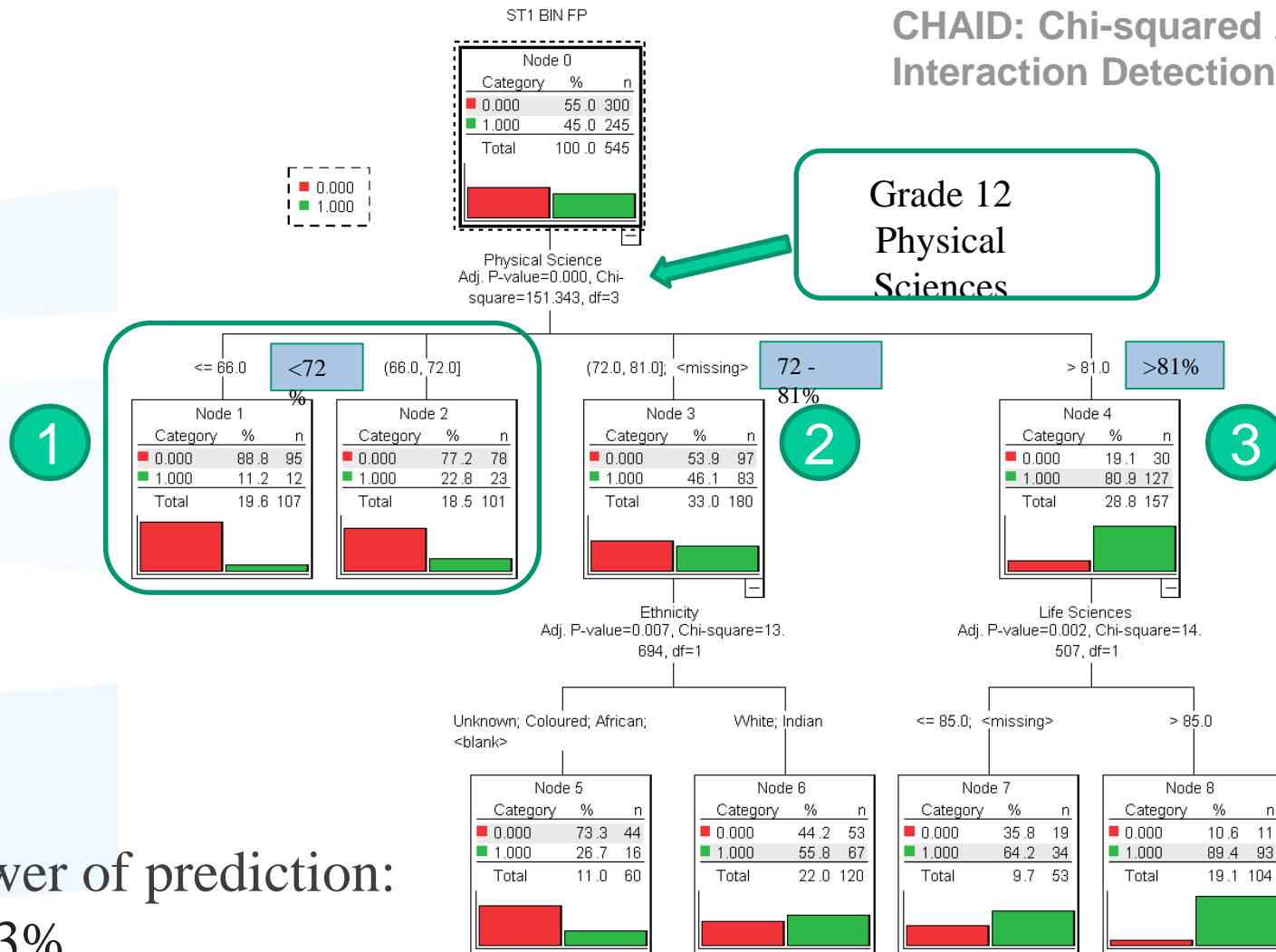- Optional activities used for enrichment for likely-to-pass students

THANK YOU.

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Categorisation by means of CHAID analysis

CHAID: Chi-squared Automatic Interaction Detection (Kass 1980)

Grade 12 Physical Sciences

Power of prediction: 72.3%

		Activities before semester test 1 (period 1)					Activities between semester test 1 and 2 (period 2)				
		At-risk Group 1	MM Group 2	LTP Group 3	Between group significance	Eta squared	At-risk Group 1	MM Group 2	LTP Group 3	Between group significance	Eta squared
Compulsory activities	**Peer led tutorial classes Average %**	77% (SD= 19%)	81% (SD= 15%)	88% (SD 11%)	$p_{(1/2)}<0.001$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.001$	0.070	71% (SD= 21%)	74% (SD= 18%)	80% (SD= 12%)	**$p_{(1/2)}=0.120$** $p_{(1/3)}<0.001$ $p_{(2/3)}<0.001$	0.04
	Connect Online quiz Average %	62% (SD= 30%)	72% (SD= 26%)	82% (SD= 20%)	$p_{(1/2)}<0.001$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.001$	0.087	60% (SD= 29%)	66% (SD= 27%)	79% (SD= 20%)	$p_{(1/2)}=0.015$ $p_{(1/3)}<0.001$ $p_{(2/3)}<0.001$	0.086
	Participation in class total count	8.2/10 (SD= 2.5)	8.7/10 (SD= 2)	9.1/10 (SD= 1.7)	$p_{(1/2)}=0.007$ $p_{(1/3)}<0.001$ $p_{(2/3)}=0.072$	0.027	6.3/ 8 (SD= 2.1)	6.6/8 (SD =1.9)	7.1/8 (SD= 1.3)	$p_{(1/2)}=0.037$ $p_{(1/3)}<0.001$ **$p_{(2/3)}<0.002$**	0.035
Voluntary activities	**Learnsmart Average %**	17% (SD= 28%)	26% (SD= 34%)	30% (SD= 36%)	$p_{(1/2)}<0.001$ $p_{(1/3)}<0.001$ $p_{(2/3)}=0.277$	0.031	8% (SD= 20%)	13% (SD= 26%)	13% (SD= 26%)	$p_{(1/2)}=0.012$ $p_{(1/3)}=0.005$ $p_{(2/3)}=0.974$	0.012
	Virtual classrooms total count	2.02/9 (SD= 1.5)	2.6/9 (SD= 2)	1.9/9 (SD= 1.4)	$p_{(1/2)}=0.068$ $p_{(1/3)}=0.933$ $p_{(2/3)}=0.019$	0.037	0.2/14 (SD= 0.7)	0.3/14 (SD= 0.8)	0.27/14 (SD= 0.7)	$p_{(1/2)}=0.401$ $p_{(1/3)}=0.576$ $p_{(2/3)}=0.952$	0.002