“Was that Interesting?” & “Does it Matter?”: The implications of On-Task learning experiences

Abstract

Interest is a critical fuel for and outcome of learning. Building on and refocusing the Four-Phase Model of interest development, this study provides a window into the ecology of the learning experience and interest it generates. This research tests a task interest model for understanding learning experiences in three university courses (mathematics, biochemistry and introduction to physics for non-majors) and pilots a micro-analytic approach to capturing these experiences during lectures/tutorials. Students' interest in tasks, a single class and the domain of study were collected. Short surveys were conducted through an online platform during class, immediately following task experiences. Latent variance-based modelling suggested strong forward connections between interest in most tasks were observed. The connections between prior knowledge and interest with future interest in course tasks varied strongly and was dependent on the nature of the tasks. The nuance of these connections and their implications for theory and practice are discussed.

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Introduction

Formal education is a place where interest should be seeded and then tended carefully to ensure it has the chance to grow. The importance of interest within formal education has been heralded for more than a century (e.g., Dewey, 1913). It is only recently, however, that researchers, drawing from recent targeted interventions (Durik, et al., 2015; Durik & Harackiewicz, 2007; Hulleman, et al., 2010; Hulleman & Harackiewicz, 2009), have begun calling for direct support for the development of student interest and pointing to its critical role as an outcome, as well as ingredient, of excellent education (Harackiewicz, et al., 2016).

It is essential to alert policy makers to the critical nature of interest’s dual roles as fuel and destination for the vehicle that is formal education. Helping educators to understand the potential of straightforward activities that can stimulate and potentially sustain interest also has tremendous value. However, there is also a danger of “a little knowledge being a dangerous thing”. Humankind’s often botched attempts at protecting species is an example of how too little knowledge and the best intentions can have disastrous effects on complex environments (e.g., Cane Toad and Australia; see Phillips, et al. 2007).

In higher education, and increasingly secondary education as well, educators often focus on what is an important outcome of and can even be an instigator for student interest: observed Engagement and/or Active Learning (Cavanagh, 2011). Educators can see physical evidence of these “positive” student experiences and often focus on these as signs of a healthy course learning environment. Seeking to increase the signs of “good learning,” instructors often increase opportunities for peer interaction during classes, which has plenty of benefits apart from increased visible engagement, and, increasingly, reach for educational technology: e.g., Polling (e.g., Blasco-Arcas, et al., 2013), Games (Oblinger, 2004), and

Virtual Reality (Merchant, et al., 2014) as solutions. It is hyperbole to suggest that these kinds of additions to courses is akin to setting proverbial cane toads loose within formal education. However, without detailed knowledge of how students' interest is built across educational experiences—i.e. without better knowledge of educational ecology—it is impossible to know what the long-term effects of even simple interventions like polling might be having on student development across years of formal education.

The current study treats interest as the critical fuel for, and essential outcome (along with knowledge) of, learning. The present study employs a practical model of interest development during formal education (Fryer, et al., 2016). This model is built on the Four-Phase Model of interest (Hidi & Renninger, 2006; Renninger & Hidi, 2011). This practical models seeks to hold the Four Phase Model's definition of interest and its development as constant, while drilling down deeply into the university course experience.

This study was designed as a pilot, two single lecture trials and a multiple lecture test, seeking to explore and expand our understanding of the fundamental connections between student experiences of interest at a task, single class and domain level in three different undergraduate courses (Organic Chemistry, Biochemistry and Introduction to Physics for non-majors). Results of modelling across the studies point to the important, but not decisive role of task nature for interest development, and the critical, differential role of prior interest and knowledge for students' task interest.

Background

Interest is both a psychological construct which has long established connections to how we interact with our world (James, 1983/1892) and a critical component of learning and, thereby, formal education (Dewey, 1913). Most people would identify as knowing what interest is and can probably talk about what interests them and how they become interested. There are benefits to reflecting on these layman perspectives of interest and its development

for personal growth and direction. However, when we are considering its impact on tens, hundreds or perhaps even thousands of individuals within formal education, a theory driven and well-tested model that can be reliably applied across context and person is critical.

Defining interest and its development

A considerable amount of empirical research has resulted in a broad definition for interest. The most basic definition divides interest into the interest individuals experience in the moment and is transitive, and the interest that individuals carry from experience to experience. These two types of interest are generally referred to as situational interest and personal interest (Renninger & Hidi, 2015). At a second level, interest in its most developed form is broadly recognised as being a collative construct which includes affective components and value, along with epistemological aspects (Renninger & Hidi, 2015). The Four-Phase Model (Hidi & Renninger, 2006; Renninger & Hidi, 2011) brings together a rich history of empirical and theoretical work that has suggested how this collative construct develops across experiences within a specific subject/object.

The Four-Phase Model depicts a developmental process wherein an individual's interest for a subject is stimulated (stimulated situational), gains some sustenance through repeated engagement (maintained situational), might transition to the early stages of a personal relationship with the subject (emerging personal) and finally can become a sustainable interest in the subject (personal interest). Across these phases, interest begins as a largely affective experience and slowly adds aspects of value for and knowledge of the subject.

The Four-Phase Model is a useful outline of how an individual's experiences with a subject might over time lead to a developed interest in the subject. This model was not, however, designed to explain how interest might develop in highly structured, often low autonomy and repetitive, learning environments found in most of formal education. It is akin

to trying to explain an animal's behaviour in a zoo with a theory developed from the wild, certainly relevant, but unlikely to be effective on its own. Building on and supplementing the Four-Phase Model, a practical, classroom-centered model was constructed and trialed (Fryer et al., 2016). This model focuses on the interconnections between students' interests in specific tasks, both in classrooms and during independent study (task interest), students' interests in a semester of specific subject (course interest), and students' interests in a subject or domain (domain interest). This model has been tested across repeated experiences of the same type of task (Fryer et al., 2016), comparing two similar classroom task experiences under experimental conditions (Fryer, et al., 2017) and a longitudinal study employing mixed methods (Fryer, et al., 2019).

Research with the Task-Course-Domain model has pointed to three important connections relevant to researching students across a semester of learning in a subject or course. The first finding is that students' interest in a specific course makes a lasting contribution to their interest in a domain but is only mediated by their interest in the course of study (Fryer et al., 2016). This makes interest in courses an important outcome. The second is that observed student engagement does not always indicate experiences that contribute to long-term interest; even the quantity of interest in a task can be misleading. The nature of the task and the quantity and quality of interest together determine long-term impact on interest (Fryer, et al., 2017). Consistent with the research summarised by the Four-Phase Model (Hidi & Renninger, 2006; Renninger & Hidi, 2011), evidence from the interventions (Hulleman, et al., 2010), and early empirical exploration (Ainley, et al., 2009; Hidi, et al., 2006), both utility-value and perceptions of ability (self-efficacy) make direct contributions to interest in a domain of study (Fryer et al., 2019). Furthermore, this relationship is reciprocal, with prior domain interest predicting future self-efficacy, self-concept, utility-value and interest in the future.

Implications of the Task-Course-Domain Model

The Task-Course-Domain model for interest in formal education, has implications based on its design and results from initial empirical studies. The model's design proposes that interest has distinct levels. Each has an impact on one another. Each level of interest should be considered by educators, with the ultimate goal of enhancing students' interest in the domain on the completion of the course of study. Evidence from empirical studies points to the critical role of tasks and the mediation of course interest for their contribution to the domain interest. Educators need to see students' interest in their course as a critical outcome of their course. Moving upstream, educators need to consider how different tasks in the course might (or might not) be contributing to students' interest in their course. Recent evidence suggests that quantity of observed engagement (relative to quality of engagement which has a lasting impact on learning outcomes such as domain knowledge and interest) might not be the best gauge for the impact of task interest (Fryer et al., 2017) and that the reasons for engagement might be just as or perhaps even more important (Fryer et al, 2019). Furthermore, perceptions of self-efficacy during and utility-value for learning during the course are also critical (Fryer et al., 2019).

This practical model of interest within formal education also has implications for evaluating learning experiences. Learning experiences are regularly only evaluated in higher education. In these contexts, course evaluations are the tool generally used. Setting aside widespread concerns of bias (e.g., instructors' gender, see Basow, 1995; instructors' age, see Wachtel, 1998) and persistent sampling issues (Youmans & Jee, 2007) with these evaluations, they generally fail to assess or even meaningfully predict the object of the course: Learning. Exacerbating these issues, the retrospective nature these surveys forces students to compile months of experiences and match to a number (Levinson, Gordon, & Skeff, 1990). In the end, course evaluations at best provide a weak evaluation of the

instructor and at worst a measure of students' satisfaction, either weakly or unconnected to student learning in the course.

Assessing students' experience from the perspective of students' interest in specific tasks, course and domain has theory-centered strengths compared to standard course evaluations. Perhaps the most important difference is a focus on one theoretically robust aspect of student experience (i.e., interest) rather than an omnibus of latent constructs with questionable construct validity (e.g. teaching, active learning, etc..) and observed elements of class (e.g., clarity of slides or legibility handwriting, pacing of materials, etc...). Interest's strong construct measurement, backed by overarching and robust psychological theory could yield clear direction for enhancing the student experience. The methodology that is paired with this theoretical approach also has clear benefits over standard means of assessing students' learning experiences. The first benefit of this assessment approach is that it is driven by short self-reports of students' interest immediately after tasks and at the end of classes across the course, rather than large surveys only at the end of the course. This addresses sampling and retrospective issues common with course evaluations. This approach addresses another, related issue. Learning and interest development are process-orientated experiences and should therefore be assessed alongside the experiences—or as closely thereafter as possible. Assessment needs to take place consistently across the entire course and needs to be built into the course and how it is taught rather than being treated as an ad hoc addition.

Another critical benefit of the approach to assessment undertaken in the current study is that it directly measures the development of a concrete outcome of courses—Interest. Interest is an important predictor of achievement (Schiefele, et al., 1993) and, perhaps more importantly, due to its resulting learning related behaviors: i.e., a desire to reengage with course content (Renninger & Hidi, 2015).).

The Current study

The current study was a series of tests of a model for interest development (Task-Course-Domain interest; Fryer et al., 2016; Fryer & Bovee, 2020, Fryer et al., 2021) in novel and challenging contexts (organic chemistry, biochemistry and introduction to physics university courses). A new mobile software platform designed to support the micro-analytic course embedded measurement of student experiences was utilised for data collection. The new software platform uses a new dynamic touch interface designed to enhance the self-report experience (Fryer & Nakao, 2019). The touch-based slide provides colour, size and a physics sensitive experience in addition to labels and number to support the user in accurately self-reporting their experience. A recent experimental test comparing the interface to standard Likert, VAS and Slide indicated that it performed better than VAS in all aspects, better than Likert in all aspects other than time to complete and presented similar accuracy of self-report as basic Slide. This test established the interfaces validity as an alternative self-report interface and provided direction for further improvement going forward. The mobile software version used here was identical to that used in the experimental test (Fryer and Nakao, 2020). The mobile software used QR codes, embedded in lecture slides after specific activities, to connect users to short surveys about their interest in the domain of study, specific tasks and the class/lecture they had just experienced.

Students' interest experiences in one class for each Organic Chemistry (90 mins) and Biochemistry (120 mins), and across three classes for Introduction to Physics (60 mins each) were assessed and modelled. The hypothesised models, analysed as latent models, are presented in the appendices (Figures 1, 2 and 3).

Aims

The current study aimed to test the longitudinal relationships between students' interest in course tasks, a single class within a course, the broader domain of study and their prior knowledge of the domain of study. Specifically, what is the predictive power of students' interest in different types of tasks for their interest in a specific class within a course (Research Question 1)? This test was undertaken in one class of an organic chemistry and biochemistry course. From the other direction, what is the longitudinal effect of prior knowledge and interest in a domain of study on students' interest in future tasks during an Introduction to Physics for non-majors (Research Question 2)? Finally, what are the interconnection between students' interest in very different tasks across all three contexts was tested (Research Question 3)? Due to the lack of interest research for learning environments like those included in the current study, no specific priori hypotheses were set.

Methods

The current study set out to test the connections between students' interest in tasks, a specific class or course, the study domain and prior knowledge. This study was undertaken in three university courses: a second-year organic chemistry course, a second-year Biochemistry course and an Introduction to Physics (for non-majors) course.

4.1 Procedures, Participants and Ethical Clearance

First and second year students studying at one research intensive university in Hong Kong participated in the four studies conducted. Initially, a pilot in four lectures of a first/second-year mathematics course was undertaken. During these lectures, the short surveys and mobile self-report interface were tested. During this pilot the procedures for conducting the research during lectures were refined and consolidated. Following the pilot, students were invited by one of the researchers to complete between one and three short

surveys during a single lecture (Organic Chemistry and Biochemistry) or across three lectures (Introduction to Physics for non-majors). In each of the four studies students were reassured that participation was voluntary and completely anonymous. During the lectures, students were invited to connect to the online software platform (created for the project) through a QR code displayed on slides. The course lecturer determined when the interest measures would be completed, in concert with the specific tasks and the overall flow of the lecture. Each survey took on average 49 seconds to complete. Only students completing all items for at least 2/3 surveys (Organic chemistry = 29; Biochemistry = 29) and 4/5 surveys (Intro to Physics, $n = 35$) were included in latent modelling for the current study.

Ethical clearance to undertake the study was sought and received from the University's Human Research Ethics Committee (HREC Reference Number EA1608028). As part of the ethics procedures for the current study, all students read an overview of the project and were informed of the voluntary nature of their participation and given the option to leave the project at any time.

Instrumentation

Across the three courses included in this study the same three interest surveys were used (see Table 1 in the Appendices). Keywords identifying the course and domain in the items were changed for each course. The majority of these items had been successfully used in previous studies and the interconnections between students' interest at various levels during a specific university course were also examined (e.g., Fryer, et al., 2019; Fryer et al., 2017), demonstrating robust construct validity and reliability in each case.

Analyses

Variance-based latent structural equation modelling (SEM), Partial Least Squares (PLS) latent modelling, was used to assess the lecture experiences examined in the current

study. Depending on sample size and the nature of the data, variance-based SEM modelling is preferred over covariance SEM for a few reasons. Like covariance latent SEM, PLS latent modelling offers the benefits of latent variables, full model tests, and, additionally, it is robust to non-normality issues (Hair Jr, Hult, Ringle, & Sarstedt, 2016; Kock, 2015), linked to ordinal Likert-type data (Flora & Curran, 2004) For smaller samples (Jannoo, Yap, Auchoybur, & Lazim, 2014) where convergence issues is independent of complexity of the tested model variance-based SEM is preferred.

SmartPLS was used for all Structural Equation Modelling (SmartPLS GmbH, 2019). Prior to finalizing each of the models tested, construct validity and reliability was assessed based on guidelines included in Hair, et al., (2019). Across the models, Variance Inflation Factor (VIF) for composite variable items and composite variables collinearity was calculated and assessed. VIF of 3 or less is preferred with > 5 indicting critical collinearity. Average Variance Explained (AVE; a measure of convergent validity) was similarly calculated and reviewed, with values of .50 or greater being preferred. Factor loadings for each composite variable were examined, with loadings of .50 or greater being preferred. At a final stage, composite variable's reliabilities were tested, employing Cronbach's Alpha and Rho(a). For each reliability measure .70-.90 preferred, $< .70$ suggesting poor reliability and $> .95$ indicating redundancy for indicators.

To assess whether the sample size was sufficient to confidently test each of the three models included in the study a regression power analysis was conducted for each dependent composite variable. Power analyses were conducted using G*power (Faul, et al., 2007).

For the current study Keith's (2015) guidelines for the interpretation of beta coefficients in researching influences on learning specifically were utilised: β s below 0.05 are “too small to be considered meaningful;” those above 0.05 but less than 0.10 are “small but

meaningful;” those above 0.10 but less than 0.25 are “moderate”; and those above 0.25 are “large.”

Results

Modelling preparation

Missing data for the each of the three data sets presented were less than 10 percent, satisfying the cut-offs suggested by the field (Hair, et al., 2009). The missing data were imputed prior to analyses using JMP 9.01 (SAS, 2007-2011). Collinearity (VIF) was well below 3 for all constructs in all three models. For the physics model three items were > 3 but less than 4.5, but each one was considered to be theoretically meaningful for the constructs being measured and were not removed. Collinearity was not an issue for indicators included in the Biochemistry and Organic Chemistry models (i.e., < 3). All indicators presented significant ($p < .01$) factor loadings $> .50$ suggesting their individual relevance to the composite constructs.

Table 2 presents the latent inter-correlations, reliability and descriptive statistics for each model. Given the focus of the current study on modelling outcomes and the three models to be presented and discussed, inter-model correlations are not reviewed, but instead included in the appendices for the interested reader. The AVE for all constructs was above the cut-off (.50) indicating sufficient convergent validity. Reliability for all scales met or exceeded the accepted guidelines ($> .70$; Devellis, 2012). Finally, for all dependent constructs in the three models presented, a power analysis for regressions suggested sufficient power for the resulting composite variables' R^2 .

Biochemistry

The outcome of the lecture (class) interest test for the Biochemistry course is presented in Figure 4. Students' interest in the short lecture presented a large β (.45; $p < .05$)

for their interest in 90 min lecture. The group activity presented a medium, not significant β (.29; $p = .09$) for future interest in the class (90 minute lecture experience). The variance explained for students' interest in the lecture was medium in size ($R^2 = .47$) (Cohen, 1988).

Figure 4. Second-year university Biochemistry course: Lecture, group activity and class (lecture) interest. Modelling outcome.

Note: * $p < .05$, ** $p < .01$

Organic Chemistry

The outcome of the lecture (class) interest test for the organic chemistry course is presented in Figure 5. Students' interest in a problem set completed during the lecture presented a strong direct β for their interest in a subsequent short lecture ($\beta = .58$; $p < .01$) and a medium β for their interest in the 20-minute lecture at its conclusion ($\beta = .22$; $p = .4$). The short lecture presented a strong β for their interest in the 200-minute lecture ($\beta = .47$; $p < .01$). The variance students' interest in the short lecture and the lecture as a whole were both medium in size ($R^2 = .33$, $R^2 = .39$) (Cohen, 1988).

Figure 5. Second-year university Organic Chemistry course: Problem set, short lecture and class (lecture) interest. * $p < .05$, ** $p < .01$

Introduction to Physics

In contrast to the previous two tests, the Introduction to Physics model was designed to test the connections between what students bring with them to a course and their on-task course experiences. The individual differences were measured at the beginning of the course: prior knowledge of the course contents (pre-test) and prior interest (domain interest scale). These initial individual differences were modelled as predicting future interest in course tasks, along with tasks' forward inter-connections. Prior knowledge presented a moderate β for a Think-Pair-Share activity ($\beta = .21, p = .1$) and writing exercise ($\beta = .48, p < .01$)—one and two weeks in the future respectively (See Figure 6). Prior knowledge presented a smaller and negative β for students' interest in a short lecture ($\beta = -.19$) suggesting a very different relationship compared to the other two tasks. Prior interest presented a positive β for the short lecture ($\beta = .53, p < .01$). In contrast it presented a negative relationship for a writing exercise ($\beta = -.30, p = .22$) and a very small β for Think-Pair-Share ($\beta = -.03, p = .9$). Students' interest in the short lecture positively predicted interest in the Think-Pair-Share ($\beta = .64, p < .01$), but presented a very small effect for the writing exercise ($\beta = .01, p = .7$). Students' interest in the Think-Pair-Share activity presented a moderate β for the writing exercise ($\beta = .26, p = .23$).

The variance explained for the short lecture ($R^2 = .30$), the think-pair-share ($R^2 = .59$) and writing exercise ($R^2 = .28$) (was medium in size; Cohen, 1988).

Figure 6. Cross faculty Introduction to Physics: Prior interest, lecture, paired activity and writing activity. $* p < .05$, $** p < .01$

Discussion

The current study provided two contrastive perspectives on the relationship between students' interest in two common types of tasks within university courses (a chunk of lecture and activities such as a short quiz or problem set) and their interest in the class (Research Question 1). Results suggest that task type does not clearly predict the relative importance of tasks for future interest development. Prior knowledge and prior domain interest each had very different relationships with future task interest. Students with greater prior knowledge were more likely to be interested in demonstrating it (writing exercise). Students with more prior interest were more likely to be interested in the lecture (Research Question 2). The interconnection between students' interest in course tasks were strong across all two courses

examined confirming the type of cumulative growth observed in past research with this task-centered model (Fryer et al., 2016) (Research Question 3).

Implications for theory

It is logical and theory also supports the notion that interesting experiences build toward interest in a topic (Hidi & Renninger, 2006; Renninger & Hidi, 2011). Results from the current study, along with previous research examining interest in classroom tasks (Fryer et al., 2016), suggest that interest in prior tasks might enhance interest in future tasks: like nudging along a speeding body, they might be increasing its mass along with its speed—and therefore their impact (resulting interest). Further research is necessary to understand the potential knock-on effects of an uninteresting task to determine whether these kinds of connections can also lead to interest decline.

Prior interest and prior ability have a dramatically different impact on task interest. The nature and perhaps challenge of the task are each likely to play a significant role in these relationships. Interest and knowledge are hypothesised as growing together over time (Alexander, 2003; Hidi & Renninger, 2006; Renninger & Hidi, 2011), but with the kind of modularised learning that takes place in formal education contexts, where interest in the course is a crucial nexus for task interest to contribute to longer term domain interest, theory might have to be adjusted to account for the jarring stop and start of learning processes across and then between courses.

Implications for practice

Due to the cumulative growth of interest across tasks, there might be theoretical and practical value in starting a class with an activity to kickstart and support student interest in activities that follow. While it might seem intuitive that the kickstarting activity be something active, results from the present study suggest that a well-structured and well-paced chunk of lecture will also be appropriate.

Results from the current study point to the equally critical roles of prior interest and knowledge for students' interest in classroom activities. The fact is that students come to class with a wide range of prior knowledge and interest. While the Introduction to Physics for non-majors was almost certainly an extreme case, it is not unreasonable to suggest that this is an acute issue for most first-year courses in any major. Two important ways that instructors might begin to address—worst case scenario, mitigate— this issue are firstly, to learn more about the students and secondly, use a wide variety of activities that meet the needs of low and high interest/knowledge student during every single class. By “learn more”, what is meant is collect some data early on. Give a pretest and a short survey about students' interest in the course. To ensure honest responses, consider making both of them anonymous. Be sure to collect background information such as academic year, gender and faculty, as these will give additional meaning to the results. “Variety of activities” does not mean choosing any (different) activities. The results of the current study provide some directions for the selection of appropriate activities. Lectures might support students with higher interest and lower knowledge at one end of the spectrum and writing activities might support lower-interest higher-ability students, with peer-learning activities being somewhere in between. From receiving new information, to light peer sharing and personal demonstration of knowledge, there might be a continuum from high to low support for and from prior knowledge/interest. Rather than focusing on the middle exclusively, which is so popular in this era of active learning, meeting the needs of the entire student body will demand a mixture of activities from across the continuum.

Future Directions

The present study was a first attempt to trial capturing and modelling students' interest experiences across a single class (Organic Chemistry and Biochemistry) These initial tests were extended by a follow-up with student across multiple classes (Introduction to

Physics) controlling for prior interest and knowledge. While PLS modelling is an effective tool for latent modelling, the small sample size resulted in non-significant findings for some moderately-sized β s. Future studies will need a more generous n -size if they are to recover all meaningful β s.

The current study targeted very specific course contexts (early year university science courses), because this was seen as a challenging lecture context that needed support.

However, for the preliminary results found here to have meaningful external validity and be built on, studies of this kind need to be undertaken in every possible classroom environment tertiary education supports. Furthermore, this kind of research need not be restricted to tertiary education. In this era of declining interest in STEM subjects and careers (Kier, Blanchard, et al., 2014), this kind of research might provide direction for curricula and instruction to stem the ebb and perhaps support the flow of students into this critical area of study from secondary education.

Results from the third model should make it clear that pre-testing students and thereby ascertaining their prior knowledge is a crucial step towards understanding their interest in course tasks. Future research must include pre-post tests of course knowledge in order to ensure research results yield information about the entire class, where they start, where they end and how they get there.

Each of the models presented arose from short studies—three classes at most. To understand the dynamics of students' studying across a semester, effect of similar tasks being repeated each week, and the role of different contents as the course progresses will all take longer studies. These studies could be built right into the course and their materials from the outset (for an example see Fryer et al 2021). Researchers working with course instructors could devise a course programme of interest assessment that might address instructors

concerns and theory together, while ensuring the minimum necessary interference to students' learning.

Qualitative triangulation is crucial for understanding why certain course activities work and others fail. Either paired observers for class-wide and nested activity or recording at least some classes are strongly encouraged, both for theoretical research and action research purposes. Instructors seeking to complement the quantitative process orientated approach to assessing students' course experiences with feedback from students about other aspects of the course are encouraged to pursue intermittent qualitative approaches (e.g., Fryer, 2009).

Conclusions

The first and most straightforward conclusion that might be drawn from modelling in all three courses is that lecture experiences can drive future interest, both in tasks and the entire class experience. That said, it should be noted that each of the lectures assessed were well organised and appropriately paced, which certainly played a role in their contribution to interest.

In contrast to the conclusions drawn from students' lecture experiences, it is at the same time important to point out that tasks included for their "active" component (group/peer activities, problem sets) can fail to support future interest, suggesting that the engagement desired by instructors and observed during some activities like these can simply be a short excursion down a scenic cul-de-sac.

Finally, this study's findings confirm the critical role of students' prior interest and knowledge within course experiences. These results emphasize the absolute need that both be taken into consideration when designing and delivering course content. Regular student feedback about the development of these two as critical outcomes is a crucial factor for ensuring that the additional instructional effort is having the desired effect.

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Was that interesting?

11. Appendices

Table 1. Scale items for all models

Domain interest
Physics is an interesting area of study.
Physics is a worthwhile area of study
I like to learn about Physics.
I want to learn more about Physics.
Class interest
This was an interesting class. (Biochemistry, Organic Chemistry, Physics)
This was a worthwhile class. (Biochemistry, Organic Chemistry, Physics)
I like to learn in this course. (Introduction to Physics)
I want to learn more in classes like one. (Introduction to Physics)
Task interest
This activity stimulated my curiosity about Biochemistry, Organic Chemistry or Physics.
This activity was personally meaningful. (Physics)
This activity was interesting. (Biochemistry, Organic Chemistry, Physics)
I enjoyed learning about Physics during this activity.

Was that interesting?

Figure 1. Second-year university Biochemistry course: Short Lecture, Group activity and class (lecture) interest.

Figure 2. Second-year university organic chemistry course: Problem Set, Short Lecture and class (lecture) interest

Was that interesting?

Figure 3. Cross-faculty introduction to Physics: Prior interest, Short Lecture, Think-Pair-Share activity and writing activity.

Was that interesting?

Table 2. Correlations, Reliabilities and Descriptive Statistics for three studies

Biochemistry					
	Lecture	Group Activity	Course Interest		
Lecture	1				
Group Activity	0.58	1			
Class Interest	0.77	0.66	1		
Means	3.20	3.25	3.15		
SD	1.19	1.25	1.09		
Cronbach's Alpha	0.83	0.77	0.67		
rho A	0.94	0.79	0.71		
Average Variance Explained (AVE)	0.68	0.54	0.53		
Organic Chemistry					
	Lecture	Problem set	Class interest		
Lecture	1				
Problem set	0.64	1			
Class interest	0.67	0.6	1		
Means	3.6	3.4	3.6		
SD	0.83	1.05	1.13		
Cronbach's Alpha	0.81	0.62	0.82		
rho A	0.99	0.83	0.82		
Average Variance Explained (AVE)	0.8	0.56	0.69		
Introduction to Physics					
	Prior Knowledge	Prior Interest	Lecture	Pair task	Writing exercise
Prior Knowledge	1				
Prior Interest	0.4	1			
Lecture	0.01	0.5	1		
Pair task	0.24	0.45	0.5	1	
Writing exercise	0.45	0.04	0.18	0.37	1
Mean	2.97	3.65	3.88	3.78	3.38
SD	1.69	0.93	0.6	0.79	0.97
Cronbach		0.88	0.89	0.86	0.86
rho A		0.9	0.92	0.9	0.86
Average Variance Explained (AVE)		0.67	0.67	0.6	0.62