



# PE Large Lecture Theatres – Fall 2013

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## Student Data Report

Learning Environment Evaluation Project

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June 02, 2014

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## 1. Executive Summary

In the Fall 2013 term, the Learning Environment Evaluation Project (LEE) investigated Large Lecture Theatres at the University of Lethbridge campus. This investigation was part of the larger research study conducted by LEE that investigated the effectiveness of a variety of campus teaching and learning spaces, and the first of a two-part study of large lecture theatres. This specific aspect of the research was intended to inform the planning process of the Destination Project New Academic Building.

The purpose of this report was to outline student perceptions of and experiences in the two largest lecture theatres on campus, PE250 (capacity: 299 students) and PE275 (capacity: 185 students). Student surveys (n = 577) and focus groups (n = 8) were conducted throughout the Fall 2013 term in conjunction with a) classroom observations and b) faculty interviews. The survey and focus group questions pertained to the effectiveness of PE250 and PE275 as learning spaces and included the overall perceived effectiveness, physical aspects, and technological aspects of the rooms.

All participating students generally thought of PE250 as a better learning space than PE275. In fact, PE275 ranked significantly worse on 11 of 14 survey items. This ranking was reinforced by student comments in the focus groups. Students emphasized that for their function as large lecture theatres, they were both good rooms. Student expectations about learning activities in these rooms were that classes would be primarily lecture classes. Class discussion was limited, but worked relatively well when it occurred in PE250 and not very well in PE275. Acoustics from the back half and the wings in both rooms were described as suboptimal, as students had trouble hearing other students' comments or questions. Students in PE250 liked the ceiling height and the semicircular and tiered structure of the room, which were thought to contribute positively to (a) sightlines, (b) engagement, (c) focus, and (d) interaction. The main problems with PE275 were (a) the patchy lighting and the general darkness of the room, (b) the location of the projection screen and the resulting poor sightlines to the board, and (c) the crowdedness of the room, including the single entrance/exit door. Students appreciated the thought that was put into the design of PE250, including the wood panelling and the skylights. Natural light in particular seemed important to students. In PE275, aesthetics were described as boring and the walls as too starkly white. Lastly, row spacing in both rooms was considered less than ideal. Whereas some students severely disliked the large class sizes, others were less concerned with it.

Recommendations largely pertain to the room layout. PE250 in its semicircular shape and steeper tiering seemed to boost its effectiveness as a learning space, as students reported excellent sightlines, better acoustics, and improved interaction, focus, and engagement in the room. In PE275, which is the smaller of the two lecture theatres, that was not the case. Lastly, lighting was described as an important aspect that was superior in PE250 as well. Future spaces should look to PE250 as an example for how to build an effective large lecture theatre that facilitates student learning.

## 2. Study Design

### 2.1 Design

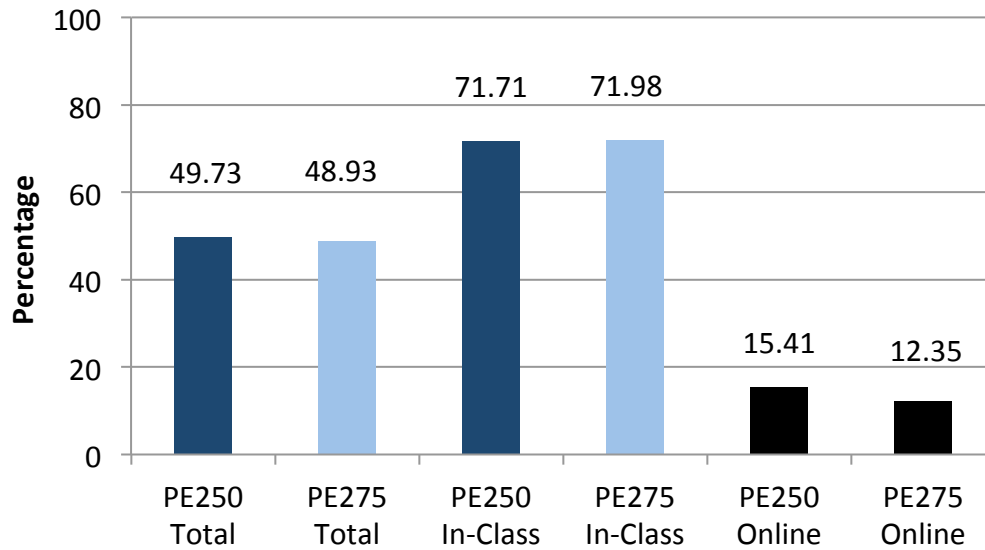
In the Fall 2013 semester, LEE conducted six student surveys and four student focus groups regarding the large lecture theatres PE250 and PE275. These were part of a larger Learning Environment Evaluation (LEE) research study that investigated both student and faculty perceptions on the effectiveness of large lecture theatres on the University of Lethbridge campus. In this report, only student data are presented. Student surveys took place from October 1<sup>st</sup> to October 18<sup>th</sup> in the Fall 2013 semester. This timeframe was chosen to allow students exposure to the classrooms for at least three weeks prior to assessing their perceptions via a survey, and to allow time for data analysis prior to the focus groups. Student focus groups took place from October 21<sup>st</sup> to November 6<sup>th</sup>. Student surveys were collected in class, so that students would be in the space they answered questions about. Two exceptions to the survey data collection were made, as two instructors preferred not to use in-class time for the survey. Therefore, the survey was administered online and included a photo of the classroom for student reference. Student focus groups were administered in the Teaching Centre and classroom photos were shown as a slideshow throughout the duration of the focus groups.

### 2.2 Methods

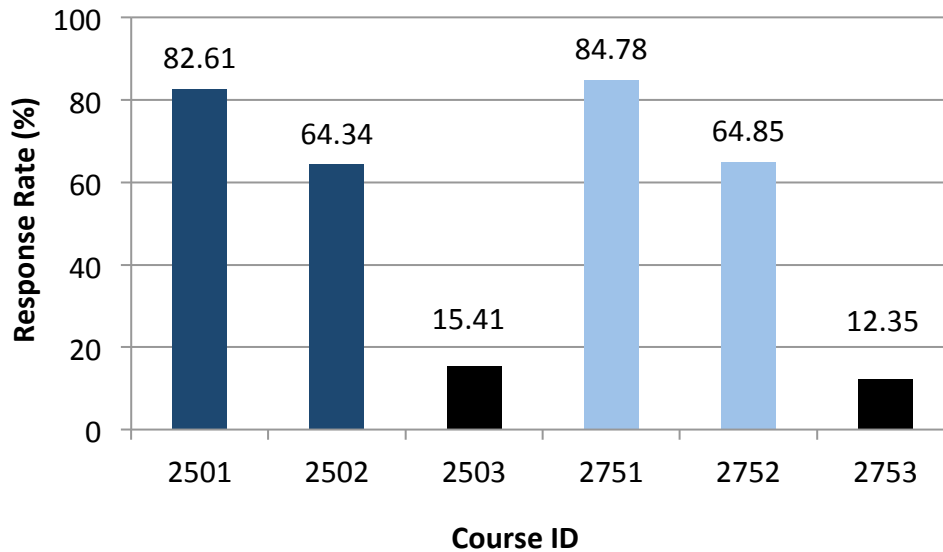
#### ***Participants***

The six classes had a total enrolment of 1167 students, and LEE collected 577 valid student surveys (49.44%),  $n_{PE250} = 372$ ,  $n_{PE275} = 205$ . Overall response rates by room replicated this number and were 49.73% in PE250 and 48.93% in PE275. Response rates for in-class surveys averaged 71.85%, whereas those for online surveys only elicited 13.88% on average. Focus group response rates were based on the student pool of 577 students, who were invited to the focus groups at the time of the survey, and ranged from 0.35% to 2.25%,  $M = 1.14\%$ ,  $SD = 0.78\%$ . Focus group attendance rates based on sign up ranged from 11.11% to 100%,  $M = 36.84\%$ ,  $SD = 36.26\%$ .

### Survey Response Rates based on Enrollment by Room (PE Fall 2013)

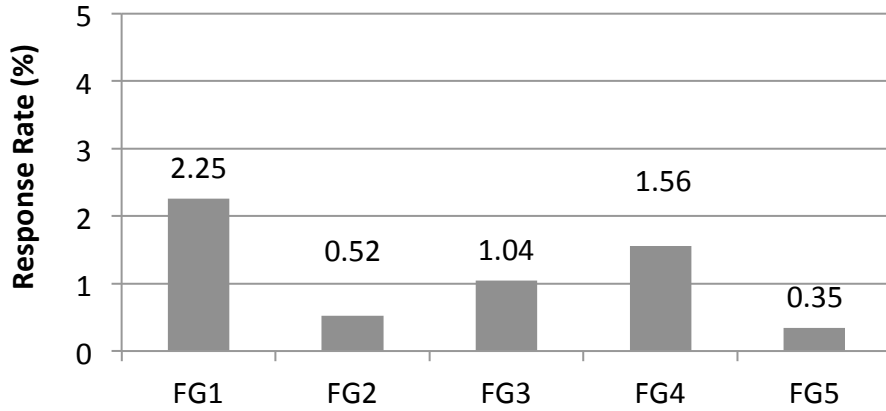


### Survey Response Rates based on Enrollment by Course (PE Fall 2013)

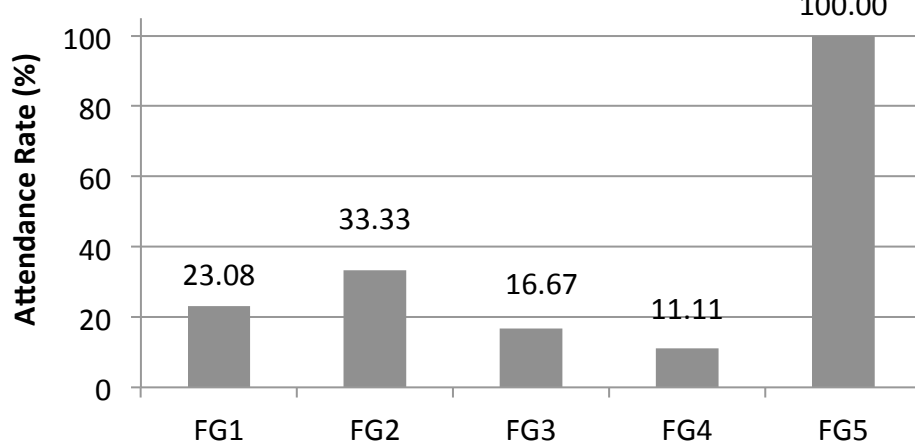


Note: Blue bars indicate in-class surveys, black bars indicate online surveys.

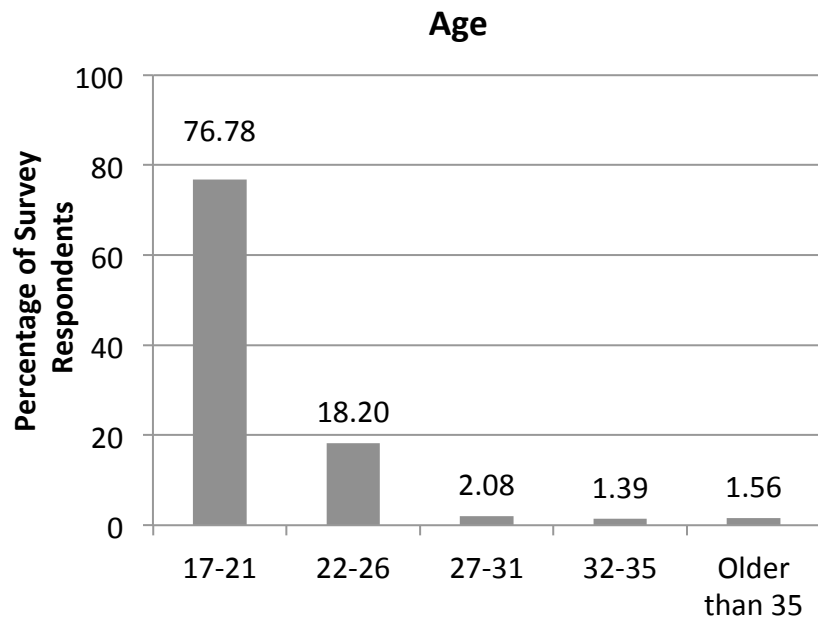
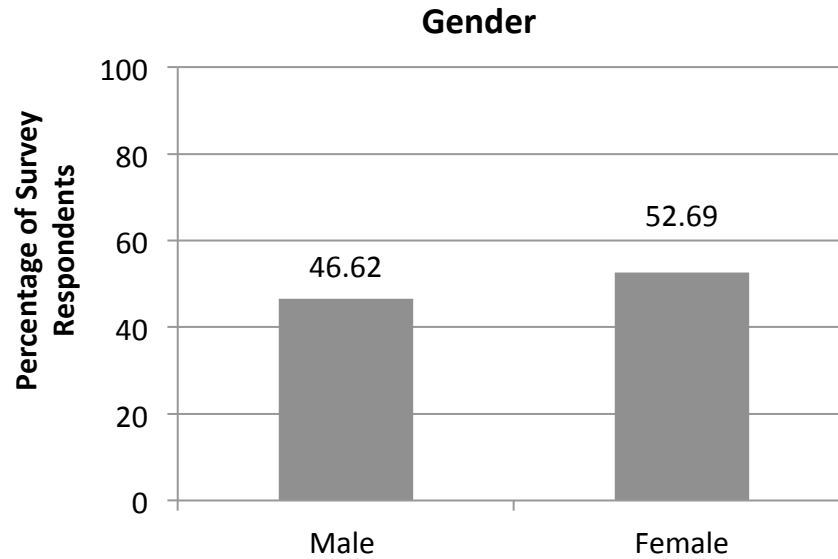
**Focus Group Response Rates based on Student Survey Pool (PE Fall 2013)**



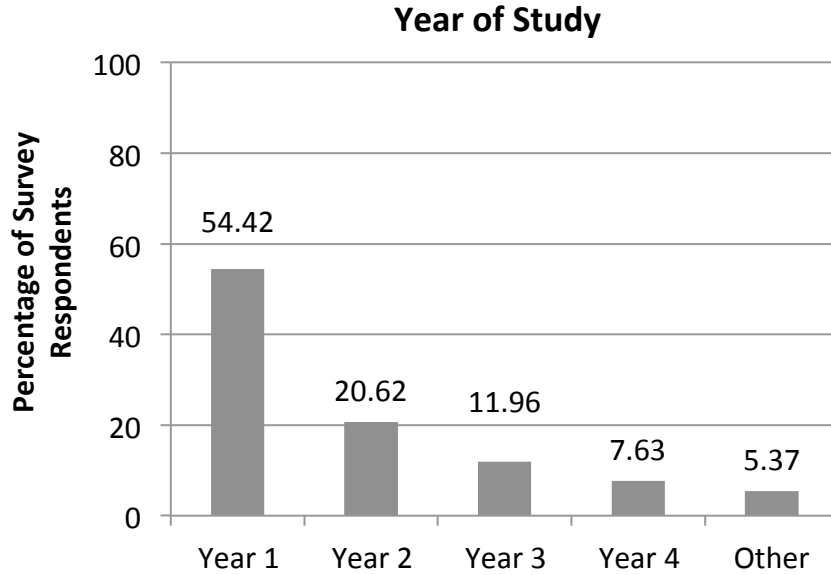
**Focus Group Attendance Rates based on Signup (PE Fall 2013)**



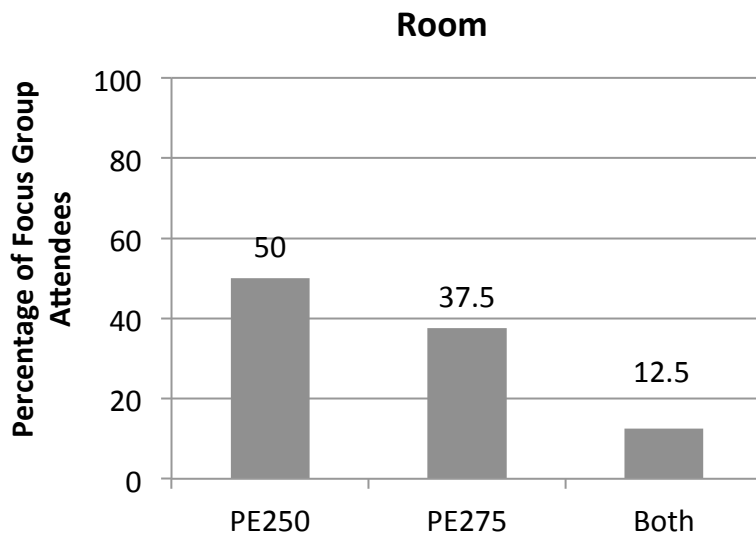
In the following, the demographic information for (a) survey respondents and (b) focus group attendees is presented. For survey respondents, demographic information in both rooms was similar, except that PE275 had more 2<sup>nd</sup> year students (38%) than 1<sup>st</sup> year students (15.1%) and these data were reversed for PE250 (11%, 76%, respectively). Gender was relatively evenly distributed, and over 75% of participants were younger than 22.



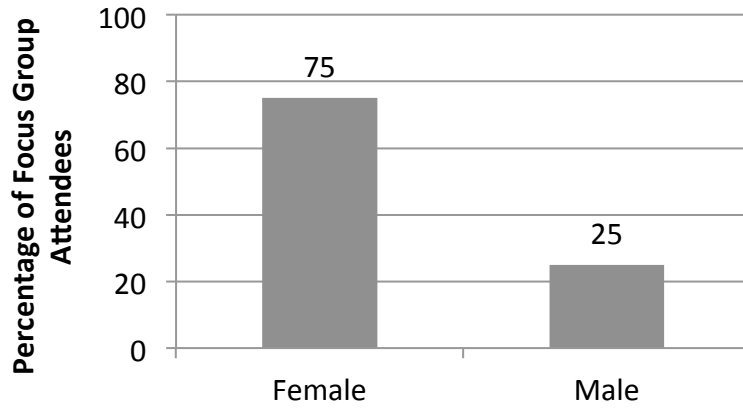




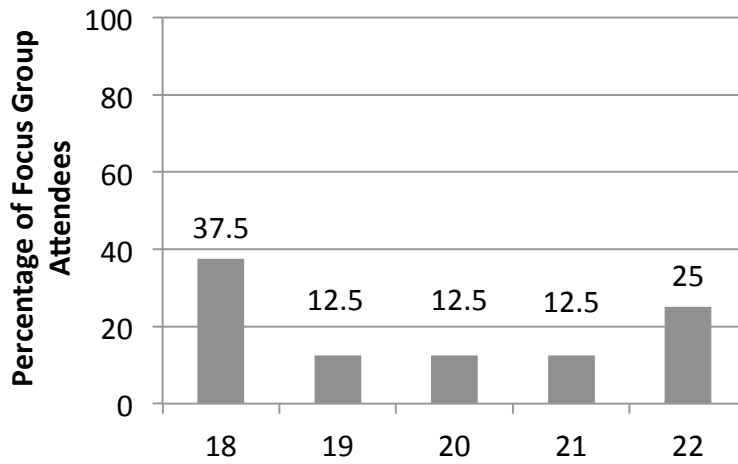
For the focus groups, ages of participants ( $n = 8$ ) ranged from 18 to 22, with a mean age of  $M = 19.75$ ,  $SD = 1.75$ . 75% of participants were female, and 62.5% were in their first year of study. Out of all focus group attendees, four indicated their classroom as PE250, three as PE275, and one indicated both rooms. The graphs below identify the details of the demographic information of focus group attendees.



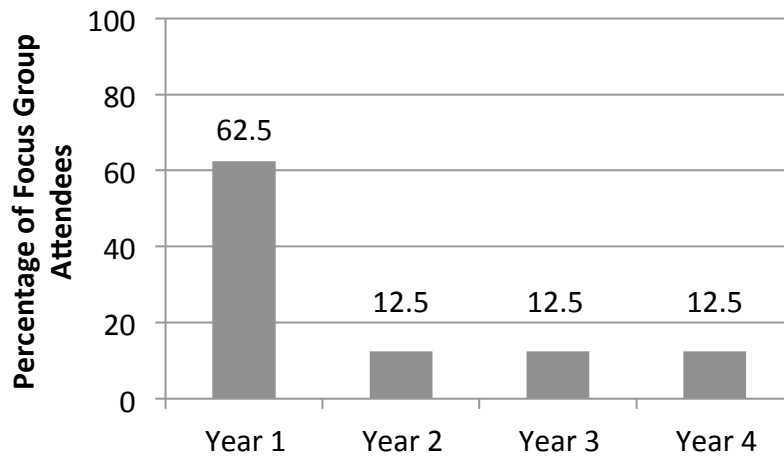
### Gender



### Age



### Year



### ***Instruments***

Questions on the in-class student survey included (a) demographic information, (b) general questions on the effectiveness of the room as a learning space, and (c) questions pertaining to physical factors of the room. For the complete formatted survey template, please see Appendix A. For the student focus groups, a semi-structured interview guide was used. As per the nature of the semi-structured, qualitative investigation, follow-up questions were asked to obtain clarification when required or to further explore participants' comments and insights. The questions are presented here:

1. How does this room make you feel?
2. What do you think about the configuration of this room? Layout of tiers? Wings?
3. Technology plays a role in many classes. How well did the technology in this classroom work? Try to differentiate between the technology and your instructor's ability to use the technology.
  - projector
  - audio system, microphone
  - document camera
  - whiteboards, whiteboard space
4. Being able to see your instructor can be an issue in some rooms because of sight lines. How do you feel about sight lines in this room?
5. Lighting is important in classrooms to allow students to see both their notes and the course material well. What do you think about lighting in this room?
 

Follow-up may include:

  - lighting in seating area vs. whiteboard
  - lighting during conjunction of projection/whiteboard in use
6. What do you think about the sound quality and noise levels in this room?
7. Room climate can have many factors. One that is spoken about most often is temperature. What other factors of room climate impacted your learning in this space, and how? E.g., air quality?
8. Comfort is important to some people. Furniture can have an impact on comfort. That may include the chairs you sit in and the desk space you have for your notes, computer, etc. Do you have any comments on furniture?
9. The aesthetics of a space can have a subconscious effect on the occupants. Are there aspects of the aesthetics of this room that you have noticed (good or bad)? One aspect of aesthetics is colour, such as wall colour.
10. Taking the previous areas into account, how does this room impact your learning?
11. If there were one thing that you could change about this classroom, what would it be?
12. What would your ideal classroom look like? (for this course? in general?)
13. Room specific question:
 

PE250:

Many students comment that this room is one of the best rooms on campus. What is your opinion on that? What are some of the features that make it a better (or worse) room than others?

*Prompt: such as PE275?  
Aesthetics/colour  
ceiling height  
screen/whiteboard conjunction  
sight lines  
lighting control  
acoustics  
any other aspects discussed*

PE275:

Many students comment that PE250 is one of the best rooms on campus. How does this room compare to PE250? What makes this room better/worse?

*Prompt: aesthetics/colour  
ceiling height  
screen/whiteboard conjunction  
sight lines  
lighting control  
acoustics  
any other aspects discussed*

14. Is there anything about this room that we have not asked about that you would like to comment on – good or bad? Other comments?

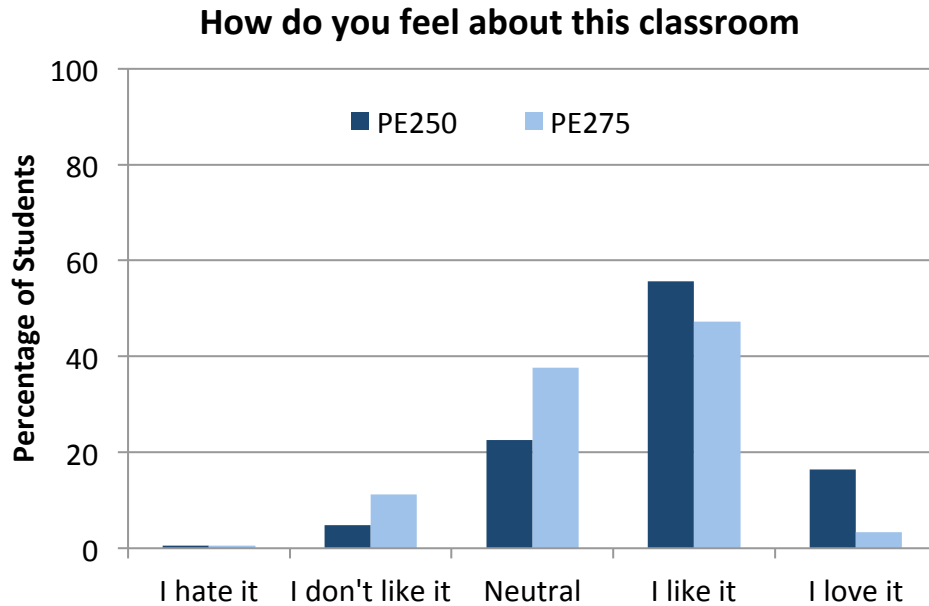
Questions 1 through 11 were considered primary questions, as they primarily related to the specific room in which the faculty member taught (PE250 or PE275). Questions 12 through 14 were considered secondary questions, as they pertained to more general topics (ideal classroom, PE250 as a favourite student room). Follow-up topics of interest are listed as prompts underneath the main question regarding the rooms (question 13).

### 2.3 Analysis

Survey data were analyzed using SPSS 21 (IBM Statistics). Data were ordinal (rating scales of 1 to 4) and often negatively skewed; therefore, a Mann-Whitney-U test was conducted in which all variables were entered. Student focus groups were audio-recorded for note-taking purposes and then transcribed. Data were analyzed using a thematic analysis process (Braun & Clarke, 2006) with assistance of the qualitative data analysis tool NVivo 10 (QSR International). It must be noted that NVivo is a program that allows for digital organization of the data, and does not in any way offer interpretations. All interpretations constitute the work of the author. Both deductive and inductive results are reported. Deductive data are those themes that stem from direct questions and constitute the answers to the questions asked. Inductive data are those themes that emerged throughout the analysis.

### 3. Student Survey Results

Following some demographic information, students were asked 14 questions pertaining to (a) the effectiveness of the learning environment and (b) specific factors in the room. First, students were asked to rate their overall feeling about the classroom on a scale of 1 (*I hate it*) to 5 (*I love it*). A Mann-Whitney test revealed that students liked PE250 better (mean rank = 317.45) than PE275 (mean rank = 237.37),  $U = 27546$ ,  $Z = -6.06$ ,  $p < .001$ .



Further, PE250 ranked higher as an overall effective space in which to hold the course, in physical comfort, and on an additional eight out of nine physical factors, except for noise level. Full results are presented in Appendix B. In total, PE250 outscored PE275 significantly on 11 out of 14 survey items.

## 4. Student Focus Groups Primary – Deductive Analysis

This section describes answers to the primary questions asked in the student focus groups of students in PE250 and PE275. These questions were:

1. How does this room make you feel?
2. What do you think about the configuration of this room? Layout of tiers? Wings?
3. Technology plays a role in many classes. How well did the technology in this classroom work? Try to differentiate between the technology and your instructor's ability to use the technology.
  - projector
  - audio system, microphone
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4. Being able to see your instructor can be an issue in some rooms because of sight lines. How do you feel about sight lines in this room?
5. Lighting is important in classrooms to allow students to see both their notes and the course material well. What do you think about lighting in this room?
 

Follow-up may include:

  - lighting in seating area vs. whiteboard
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6. What do you think about the sound quality and noise levels in this room?
7. Room climate can have many factors. One that is spoken about most often is temperature. What other factors of room climate impacted your learning in this space, and how? E.g., air quality?
8. Comfort is important to some people. Furniture can have an impact on comfort. That may include the chairs you sit in and the desk space you have for your notes, computer, etc. Do you have any comments on furniture?
9. The aesthetics of a space can have a subconscious effect on the occupants. Are there aspects of the aesthetics of this room that you have noticed (good or bad)? One aspect of aesthetics is colour, such as wall colour.
10. Taking the previous areas into account, how does this room impact your learning?
11. If there were one thing that you could change about this classroom, what would it be?

### Question 1: How does this room make you feel?

Students generally liked PE250. Two students stated that the room gave them a "university class" or "lecture hall" feel, and one of them said that he/she liked the atmosphere of the room. As aspects that contributed to that, students cited skylights, natural light, desktop space, the size of the room, the clear view of the board from any seating spot, and that it was "nicer than a lot of ... other classrooms." One participant thought that both rooms were too big and noisy, and that it was difficult to focus on the instructor when sitting in the back. PE275, on the other hand, was described as "closed in" and a "darker room" in comparison to PE250, and the lighting was called "bad" and "patchy." A student stated that sitting in the back of PE275

removed students from the professor and it could be hard to hear when the instructor was not wearing a microphone.

**Question 2: What do you think about the configuration of this room? Layout of tiers? Wings?**

When asked what they thought about the room configuration, students preferred the layout of PE250 to that of PE275. One student specified that it was easier to get in the middle seat in a row in PE250, and that the rows in PE275 were much tighter. Further, students commended the tiering in PE250:

Student: I love the tiered levels. I like how it's like a Greek theatre, like a stage, it really centers the focus of the room on the desk in the front.

Another student also commented that PE250's configuration facilitated focusing on the lecture. A third student compared the layout of both rooms:

Student: 250 is more of a circle so you have ... one centre with a circle around it. This one, 275, is more kind of like blocks, but they all kind of still point towards the front. The negative with 275 is, because it's less of a circle, the two outer blocks are more removed from the professor than in 250, where it is kind of more enveloping.

Students were then asked if they thought the room facilitated different learning activities. The unanimous response was that the rooms were mostly suited for lecture and limited in that aspect. One student stated that they were "good for [their] function, it's what [they are] meant for." Another student added that PE250 worked well for class discussion. As one student in PE275 eloquently put it:

Student: I think [in] a class that big [it] is really difficult to do activities, and the only time I have seen that configuration used for activities was last semester when I was in that class and we tried to break up into groups. But the class is so big and nothing is moveable, so to do group work, you kind of ... have to remove the chairs. So it's mostly lecture based in these giant classrooms. Not as much freedom to move around or to adjust in those ways. When it comes to facilitating learning, you only get to choose how close you sit; it really makes it difficult to do any group work.

Whereas some students thought that the large class size and its consequent anonymity in the big rooms facilitated them speaking up during class, others found that intimidating. Lastly, one student in PE275 remarked that the configuration of the room was limited in that the board and projection screen could not be used well at the same time, as people on the sides could not see the writing on the board.

When asked about the ideal classroom, one student thought a hybrid between PE250 and PE275 would be a good idea, so that desks did not curve around as much as in PE250, but the steeper tiering was still there. Another student spoke to the room layout and how it facilitated engagement in classroom activities:

Student: I like the arched, semicircular classrooms. The reason I like that, when you get more of a circle ... it's easier to be involved, because the class is focussed in towards the centre point. You can recognize your peers and instructors in discussion. The tiers are really good, raised seating is nice.

**Question 3: Technology plays a role in many classes. How well did the technology in this classroom work?**

Students in both rooms generally preferred their instructor using a microphone, except for one student in PE250, who thought that it did not matter whether or not the instructor used the microphone, as he/she was equally well heard in both instances. One student described the use of the microphone as "essential for the room size." Students who sat at the front of the room thought that hearing the instructor was less of an issue. Further, students in PE275 commented that the microphone did not work 75% of the time, as the batteries had not been changed or charged during the day.

When asked about the whiteboard space and the conjunctive use of whiteboard and projection screen, it became apparent that the whiteboard was hardly used in the students' classes in these rooms. Students in PE250 commented that when the whiteboard was used, it was generally clearly visible, as long as the instructor wrote large enough. In addition, the projection was described as working well. A student also stated that the conjunction of whiteboard and PowerPoint use worked well, as the projection was directly onto the wall, and the professor could write on the board (i.e., the wall) at the same time. In PE275, students explained the whiteboard was hard to see because the projection screen obscured sightlines. One student elaborated that there was "enough whiteboard space as it is, but it should be concentrated better, all in the middle, rather than across the room." Another student explained the following situation in PE275:

Student: If you, let's say, sit on the right hand side of the classroom and the lights are dimmed because of a PowerPoint, and the professor wants to write something on the board, it is almost impossible to read the board. [That is the case] especially if he writes on the side that is not closest to you [and] especially because the reflection of the lights and the way the projector works and everything else like with the screen down at the same time. It just makes it difficult to see if they do write on the board ... if you are not in the spot in front of it ... There are some things that you really can't show, it needs to be either written down on the board and ... if they switch back and forth in PE275 it kind of gets in the way.



The PowerPoint projection was described as "without glitch" and working, except for few user-related issues. Showing video generally worked well in both rooms. It was not specified whether video was shown through the DVD player or through the computer. In PE250, the document camera was not used except for one instance, and in PE275, problems related to the document camera only arose from difficulties when trying to project and write on the board at the same time. One student said that switching back and forth between the PowerPoint and the document camera was rather efficient and only took "a few seconds."

**Question 4: Being able to see your instructor can be an issue in some rooms because of sightlines. How do you feel about sightlines in this room?**

Sightlines were described as more difficult in PE275 than PE250. However, there were also occasions where the content was illegible from the back in PE250. In PE250, sightlines to the front of the room were described as largely unproblematic, but some students explained sightlines were worse when sitting in the wings or at the back of the room. Further, one student stated that, when sitting in the front, sightlines to other students were suboptimal, but sightlines to the front were still good. One student compared PE250 to PE275 directly:

Student: When I was in PE250 it was pretty decent for seeing the instructor at all times, because it is again that more circular foundation, and it is my tendency to sit at the front. I am usually at that point where I am ... staggered so you can see pretty good, and because it is elevated in 250, you have a good sight. In 275 I can see the professor all the time and the projector all the time, it doesn't matter where I am in the class. The main issue is seeing what is written on the board ... I would say the biggest issue [would] be if you were in the front row by the computer, that may block your sight.

It also became apparent that students typically sat in the same seat or same area for the entire term.

**Question 5: Lighting is important in classrooms to allow students to see both their notes and the course material well. What do you think about lighting in this room?**

Lighting in PE250, including the natural light, was described as "very good" and having "never been a problem." Instructors in the room adjusted the lights for watching videos or for PowerPoint projection. In PE275, room lighting was described as patchy, and one student explained that "if you weren't sitting just below where the light is turning on, you are in the dark patch and it's difficult to see what you are writing." Another student stated:

Student: If all the lights are up, one problem in 275 is that it is difficult to find the balance in that room with the light of the projector and the light you need to write with. The reflection of lights on the board make[s] it difficult to read. Usually the light bounces off the board when all the lights are on. You have to pick which lights are left on during lecture if

they are using whiteboard as well. In general, I have enough lighting on my desk to do what I am doing.

**Question 6: What do you think about the sound quality and noise levels in this room?**

Sound quality in both rooms was described as good overall, sometimes with the caveat that it was only good when the instructor was wearing a microphone. One student thought "PE250 look[ed] more like an acoustic room compared to PE275." Another student remarked that both rooms were "built for projecting out from the professor" and made discussion difficult if you were "talking from the back of the class, or if you [were] facing the front and the people in the back have trouble hearing you." One student would have liked to see a student microphone feature in the large rooms. Noise was a bit of an issue in both rooms:

Student: Both 275 and 250 have really heavy doors. Sometimes I have to leave earlier ... because I have classes back to back ... or people come in late. You hear when that door hits every single time someone enters or leaves. And because the hallways are busy you don't want to leave the doors open because you will get a lot of noise from outside. PE275 only has the one entrance. You've got two inner aisles, but no outer aisles. When you have to leave early, you have to walk right through the middle. That can create a ... distraction.

Another student repeated that idea:

Student: The only noise that is really distracting is the door when someone leaves; the door always bangs really loudly. Sometimes people are talking, but it's not a big issue. The only distracting noise is right before the class change is about to happen.

A student also commented that having a midterm on the weekend was the worst experience in these rooms, especially if a sport event was occurring at the same time in the PE building.

**Question 7: Room climate can have many factors. One that is spoken about most often is temperature. What other factors of room climate impacted your learning in this space, and how? (E.g., air quality)**

Students in PE250 spoke positively about the climate, one student even called it "perfect." Only one student found it too cold. Here, students drew on other rooms across campus for comparison.

Student: I haven't noticed. I'm usually pretty comfortable in the room. More comfortable than in Fine Arts. Huge variations there, some are ice cold, others are really warm. [In] W731 [we] are always a little warm.

Student: I think the climate is good, I find it a reasonable temperature. In B756 it's really cold, in PE250 it's good.

Student: [It's] not too warm, not too cold. I find it's more comfortable than UHall. There I have to take off my sweater. In [Anderson Hall] or PE I am fine. In UHall I wish I had brought shorts versus jeans.

In PE275 the climate did not seem to be as good as in PE250. One student also pointed out the climate issues all over campus:

Student: Temperature I find in 275, it can be kind of cold some days or kind of warm in some days. [It is] not [the] same temperature as the hallways. You do get temperature fluctuations. I think in general, as a student, you know you have to bring a sweater no matter how warm it is, because one of your classrooms is going to be drafty. It's never consistent, [there is] usually one classroom that will have a draft ... later on. In the winter, you are supposed to have all the hot air on, but some classrooms have them and some classrooms don't. For air quality, PE275 has no natural sunlight coming in, I don't think the air is stuffier, but it might seem stuffier. PE250 has skylights, so you get the natural light during the day or you can tell that it is kind of there. I don't think one is necessarily stuffier, but one has more natural lights than the other.

Finally, one student commented on the unsuitable placement of the air vents in PE250:

Student: The only other thing, the vents on the floor, those are a bit drafty at times, and the chairs catch on them. That's the only one downside. If I'm looking for a spot, I will try to find a spot away from them. In the summer it can be nice when you're hot.

**Question 8: Comfort is important to some people. Furniture can have an impact on comfort. That may include the chairs you sit in and the desk space you have for your notes, computer, etc. Do you have any comments on furniture?**

Students in both rooms liked the chairs, including the flexible backrest, which gave students the ability to lean back in them. One student mentioned that the chairs could get stiff after sitting in them for a longer time period. Desk space was sufficient to some, but insufficient to others. This might be due to students bringing different amounts of materials to class:

Student: It really depends on when you get into the classroom and where you sit. When you're five minutes late you don't get much room.

Moderator: People tend to spread out if they get there early?

Student: Yes they do. [It] also depends if people move the chairs in the previous class.

Moderator: What do you bring to class?

Student: I just have a clipboard and my pad of notepaper. That one thing usually, and a water bottle and a pen.

Moderator: You have ample space?

Student: Oh yeah. I can spread out if I have the room, but if I have to compact myself, I can.

Moderator: What about the desk space?

Student: In 250 yes. In 275 it seems much tighter. If I have a textbook and notebook laid out, I'm always into the next person's space ... If there was a little more space between rows. In 275 ... you are bumping elbows with everyone else.

Student: (*about PE250*) If you have a binder and everyone beside you has a binder it feels a little bit squished.

Another issue in both rooms was getting in and out of seats. One student remarked that he/she would be uncomfortable leaving class early when it meant getting out of the middle of a row in PE250, and another student noted that it was hard to get out of the rows in PE275. The leg space in PE275 was described as inadequate. Further, the width between the rows in PE275 was also noted to be too narrow for students moving behind others already sitting in their seats.

Lastly, one item impacting comfort was the single entry/exit door in PE275, which meant lots of students were waiting to get in and to leave.

Student: [In] 275, I'm never late, I try not to be. When a person is late they have to walk across the screen, or they go up this way. Everyone is watching, it's embarrassing. You don't want to be late. Getting out, it takes a while to move out of the doors, people are squished. If we had more doors...

In PE250, however, the experience was quite to the contrary:

Student: I think it's nice that there are two doors. I don't think everyone crowds in through one door. If you are late, you can come in up the stairs, come up the back. If you had to go across the front, that would be very embarrassing. If everyone has already gone into the rows and there might not be a seat at the end. You have to go through a bunch of other students. I am sometimes late, I have very small gaps in between classes and I can't help going from one building to another. People seem to come in and out in an orderly fashion and it works pretty well.

**Question 9: The aesthetics of a space can have a subconscious effect on the occupants. Are there aspects of the aesthetics of this room that you have noticed (good or bad)? One aspect of aesthetics is colour, such as wall colour.**

One of the first things mentioned by students asked about aesthetics was the lighting in the room. Several students thought the natural light in PE250 was an aesthetic bonus.

Student: Lighting is a really big thing. Most of the classes in Turcotte Hall have a very underground feel, they don't have windows ... The skylight is the big thing for me, it's very nice. I spend most days underground in the bowel of the university. It's really nice to have the semi outdoor feel.

Student: I think the lighting makes it feel more lively and cheery. I think it is nice that it's well lit. Not like a dungeon. When you walk in the room, it's an environment where you're ready to learn. Aesthetically pleasing, it would be.

Many students stated that they did not notice the colour of the rooms much until they were asked about it. The colour in PE250 was generally liked and the details of the wood panelling were appreciated. PE250 was described as "modern" and "professional." One student stated that "it look[ed] nice and well organized, ... there is not a lot of distraction. You can only pay attention to the instructor, you're not reading any funny posters on the wall," and another student even said: "It almost makes you feel like you're worthy." PE275, on the other hand, was described as "drab" and "boring." One student explained:

Student: PE275 it has slightly less appeal than 250. That's because of the colour of the walls. It would be nice to see the walls a different colour. It is very white, very stark. [It] doesn't supremely affect me.

And one student went even further in comparing the aesthetics of the rooms:

Student: [In] PE275 I have found that the room is very white. Although you don't want a lot of colour in the room, but it is very much: white walls, white ceilings, ... there is nothing super aesthetically pleasing about the room at all. It draws your focus to the front because there is nothing else interesting to look at ... But it's really boring. [There is] nothing of interest to look at in the room. 250 I think it's newer, or that's how it looks to me. It has the wood, it has a natural element, skylight, has a better environment. It is my natural preference just because it has something more than just your plain white walls and white ceiling. It has a tiny bit of ... of sunlight, and natural good-looking aspects to it.

Further, some students were asked whether they thought that the aesthetics of the room affected their learning.

Student: I guess so, because I think an environment that you enjoy more, you relax more in, or you pay more attention ... Let's say you have a boring lecture, you don't feel like you're ... trapped in a white-wall prison ... You can kind of handle it better because you do not feel like you are trapped in a prison.

Student: (*about PE250*) I feel better being in this room, it's a relaxing colour for the eyes, the natural light helps me focus, the temperature ... is not too hot so I'm focused on sweating.

Moderator: Do you think the aesthetics make it easier to focus and listen and be a student?

Student: I would say yes. Some other classrooms have really dull walls, there's less in the room, it makes it boring. Here there's more things to pay attention to, interesting things to see, you're not gonna look really far for distraction. Oh I can only look at the white walls, so I'm going to look at my phone. But here you can look at the wall colour for a bit, then pay attention again.

Lastly, students liked the semicircular nature of PE250, which one student thought made it look like a "theatre stage". Students also ascribed "openness" to the room, which they most likely attributed to the high ceiling, whereas PE275 made them feel "closed in."

#### Question 10: Taking the previous areas into account, how does this room impact your learning?

Because the aim of this research was to identify how classrooms affect teaching and learning, students were directly asked to identify how the large lecture theatres impact their learning. Students were encouraged to draw on anything that had been discussed so far, or anything else they could think of. Other than those already mentioned in Question 9, students gave the following answers:

Student: I think I pay attention more in 250 than I do in 275.

Moderator: Why do you think so?

Student: I think it's more comfortable and I can focus better. I also think the professor has a better line of sight. He can see if you're talking or texting.

Another student said that it helped him/her "focus by being centred on the teacher and nothing else to look at other than the front of the room. It's very comfortable and pretty easy to learn in." Lastly, one student elaborated on his/her answer to this question:

Student: I think so yes. I definitely know, not even these two classrooms, but other classrooms in the university. If you are in a classroom and the layout is weird and you can't read the board, it can hinder how you're learning. You can't see what's being presented or hear what's going on. Or if you

are stuck at the back of the class and you can't see what's on the board ... It can hinder what is being presented. How can you take notes or be involved if you can't hear or see what is presented? If a classroom hinders in any of these ways and you are being uncomfortable, you're not paying attention, you get fidgety, and you are not listening to what is going on. So those can definitely impact how you are learning.

**Question 11: If there were one thing that you could change about this classroom, what would it be?**

When asked about one thing that they could change in the rooms, students cited (a) making it less cramped and (b) deeper tables for PE250; and the (c) white walls and (d) the lighting on the board and (e) the angle of the projection screen for PE275.

## 5. Student Focus Groups – Inductive Analysis

This section describes mainly inductive themes. Inductive themes are themes that emerged without specifically asking about the topic. Here, answers included those spontaneously generated without a specific question preceding them. Further, this section also includes answers to very specific follow-up questions that were asked in some, but not all focus groups. Lastly, data from secondary questions that do not directly pertain to PE250 or PE275 are included here. These questions were:

1. What would your ideal classroom look like? (for this course? in general?)
2. Many students comment that PE250 is one of the best rooms on campus. What is your opinion on that? What are some of the features that make it a better (or worse) room than others?

Themes that emerged pertained to classroom technology, physical and perceptual aspects, room layout, and learning.

### 5.1 Classroom Technology

Overall, students were satisfied with the technology in the classrooms. However, students would have liked to see more plugins for devices in both rooms. The biggest problem was the location of the projection screen in PE275. Details on specific technologies, including audio, document camera, projection, and whiteboard, are described below.

#### 5.1.1 Audio

The sound quality in the large rooms was described as adequate, while it was highlighted that the instructor's use of the microphone was essential. However, in PE275, students recounted that the microphone was charged and working only 25% of the time. Audio for video playback seemed to work fine.

#### 5.1.2 Document Camera

The document camera was used with regular recurrence in PE275, but only on few instances in PE250. In PE275, switching between document camera and PowerPoint was described as

unproblematic. The main problem in PE275 was that when the whiteboard and document camera projection were used concurrently, sightlines to the whiteboard were abysmal.

### **5.1.3 Projection**

The projection itself worked well in both rooms. To reiterate, a problem presented in PE275 when the whiteboard and projection were simultaneously used, as sightlines from the front rows and the wings to the whiteboard were cut off by the projection screen. The lighting at the front was also cited as a contributor to that problem.

### **5.1.4 Whiteboard**

The whiteboard was rarely used in both rooms. If it was, legibility from the back of PE250 could be difficult. Also, the projection screen in PE275 blocked large parts of the whiteboard on the left or right side, respectively, depending on viewing angle. The reflection of lights on the board in PE275 was further described as a downside. Students liked that the projection screen and whiteboard were one and the same in PE250. One student said "an ideal classroom has everyone [in a seat] where they can see the board."

## **5.2 Learning**

Students discussed several aspects of how the rooms impacted their learning. These included how the room layout facilitated focus, the impact of the large class size, interaction with other students or the instructor, and learning activities that occurred in the room.

### **5.2.1 Attention/Focus**

Students offered opinions on how the rooms provided focus and aided with attention. Comments here pertained predominantly to PE250, but one student mentioned that focussing on the instructor was easy in PE275 as well. In PE250, on the one hand, students thought they were more anonymous, which made it easier for them to participate in class discussion. On the other hand, students thought the instructor had a clear line of sight to students, so he/she could observe students who were "talking or texting." In PE250, the room colour and layout was described as helping with focus. One student thought that the semicircular layout improved involvement in the class and focused the class towards the centre point. One student said:

Student:           Some other classrooms have really dull walls, there's less in the room, it makes it boring. Here there's more things to pay attention to, interesting things to see, you're not gonna look really far for distraction. "Oh I can only look at the white walls, so I'm going to look at my phone." But here you can look at the wall colour for a bit, then pay attention again.

Another student explained that there was little distraction, which drew the focus on the instructor. A third student said that you could pay more attention, because PE250 did not give the feel of being trapped in a prison. The room's comfort was also described as helping with focus. Lastly, the different access ways in PE250 were described as non-distracting for students who leave early and come in late.



### **5.2.2 Class Size**

Students did not comment much on the class size. In the context of having a large lecture theatre, they thought PE250 was well done for a "room that size." Some students found comfort in the anonymity that the large room and number of students created for them, while others were prevented from participating, because they found the large class size intimidating. Commonly mentioned downsides of the large class size was that students could not hear each other well, and not see who was speaking. Sitting in the back was also described as somewhat of an issue for sightlines, hearing the instructor and course content, and focussing on the class.

### **5.2.3 Interaction**

Interaction among students or between students and the instructor as well as instructor-elicited student engagement were described as difficult to achieve. Many of the problems cited here stemmed for the room size. Students explained that the instructor often had difficulties hearing when students from the back half of the room spoke, and had to take a few steps up. Interaction during class discussion was thus described as difficult. However, discussion and participation were said to be easier in PE250, due to its circular layout, compared to PE275. One student mentioned that in a small class of 20 students, interaction with the professor was good, but that in a large and crowded room, that was not the case. Students also thought that the large rooms did not facilitate different learning activities. Further, students cited the inflexible, fixed furniture and the resulting inability to move around as a barrier to interaction.

### **5.2.4 Learning Activities**

Students perceived the large lecture theatres as limited in their function. They almost unanimously said the rooms were suited for lecture and good for "what [they are] meant for," but not much else. Most of the activities occurring in the large theatres were limited to lecture. Some students in PE250 added that whole-class discussion worked fairly well in this room. As two students explained:

- Student: It has this lecture hall feel, you know the teacher will be talking to you the whole time ... It wouldn't be good for group work. It's a really big classroom. For the purpose of the lecture, [and] for an intro course, it's a good classroom.
- Student: I think [in] a class that big [it] is really difficult to do activities, and the only time I have seen that configuration used for activities was last semester when I was in that class and we tried to break up into groups. But the class is so big and nothing is moveable, so to do group work, you ... have to remove the chairs. So it's mostly lecture based in these giant classrooms. When it comes to facilitating learning, you only get to choose how close you sit.

## **5.3 Physical and Perceptual Aspects**

In this theme, students commented on the general atmosphere that the room created, the climate, lighting, sightlines, as well as sound and noise, and how these contributed to the learning environment. Sightlines, lighting, and the atmosphere were better in PE250 than

PE275. The sound and climate were comparable in the rooms, but students considered PE275 still not as good as PE250.

### **5.3.1 Atmosphere**

At various instances during the focus groups, students mentioned how the atmosphere of the rooms contributed to different aspects of the learning environment and to their learning. PE250 was described as comfortable, providing a smooth flow, aesthetically pleasing, and open. The natural light, wood panelling as a natural element, and high ceiling were said to positively contribute to the atmosphere. It was further described as homey, professional, and inviting. PE275, on the other hand, was described as depressing, drab, boring, crowded, squishy, inducing low emotions, and claustrophobic.

### **5.3.2 Climate**

Not many students commented on climate. When asked about climate in PE250, most students were generally satisfied. Students in PE275 thought the climate was fluctuating and not as good. One student elaborated on PE275 specifically and compared the room to others on campus:

Student: Temperature I find in 275, it can be ... cold some days or ... warm on some days. [It is] not [the] same temperature as the hallways. You do get temperature fluctuations ... It's never consistent, it usually one classroom that will have a draft or cool later on. In the winter you are supposed to have all the hot air on but some classrooms have them and some classrooms don't. For air quality, PE275 has no natural sunlight coming in, I don't think the air is stuffier, but it might seem stuffier. PE250 has skylights, so you get the natural light during the day or you can tell that is kind of there.

Finally, one student commented on the unsuitable placement of the air vents in PE250:

Student: The only other thing, the vents on the floor, those are a bit drafty at times, and the chairs catch on them. That's the only one downside. If I'm looking for a spot, I will try to find a spot away from them. In the summer it can be nice when you're hot.

### **5.3.3 Lighting**

The lighting in PE250 was generally liked. The natural light was always positively commended, especially the way the skylights were placed so that there was a little bit, rather than too much sunlight. In PE275, the lighting was described as patchy and dark. Students further commented on the inadequate lighting, and lighting control, above the board in PE275. The lights were said to reflect off of the whiteboard.

### **5.3.4 Sightlines**

Students thought sightlines in PE250 were excellent. They appreciated the level of tiering, which was said to help with sightlines. In fact, PE250 was compared to a theatre in terms of

sightlines. Only one student said that sightlines were not as good from the back or the wings, especially to the board. Students also expressed caution against rooms that curve around too much, so that the wing seating would be perpendicular to the front of the room, which would impede sightlines. Many students commented that in PE250, it was never an issue with trying to see over tall people in front of them, whereas in PE275 it was. Students also liked the clear view of the projection from any seat, whereas they explained they did not get that in PE275 if they did not arrive early. Further, as previously stated, sightlines to the whiteboard in PE275 were extremely poor, as the projection screen in the centre of the board blocked most of the writing behind and, depending on the viewing angle, up to three quarters of the whiteboard. One student thought this problem might be solvable with having two separate projections.

### **5.3.5 Sound/Noise**

As previously stated, the main issue in terms of sound was that students were mostly unable to hear other students along the front-to-back axis. One student expressed that the rooms were built for "projecting out from the professor," not so much for audibility from student to student, and suggested having microphones for students in the room. This problem was worse in PE275. In both rooms, students preferred when the instructor wore a microphone. In PE275, the microphone was reported as not working three quarters of the time, possibly due to low battery. Video and audio playback were described as good. One issue that was oftentimes expressed was that of instructors not being able to hear student answers or questions well. Noise from the loud shutting of the heavy doors was a problem in both rooms. The location of the rooms was also described as noisy, especially if sport events were occurring outside or if a class change was about to happen.

## **5.4 Room Layout**

In this theme, not only the overall room layout played a role, but also the aesthetic elements that contributed to the layout, as well as the furniture and its configuration. Space was a concern in both PE250 and PE275. Further, PE275 was considered aesthetically less appealing than PE250.

### **5.4.1 Aesthetics**

One of the most often cited aesthetic aspects that contributed positively to the learning environment was natural light. As one student specified:

Student: I think the lighting makes it feel more lively and cheery. I think it is nice that it's well lit. Not like a dungeon. When you walk in the room, it's an environment where you're ready to learn. Aesthetically pleasing, it would be.

That was one of the reasons that PE250 was preferred over PE275. Further, PE250 was commended for its design and colour:

Student: The design is really nice. Even in the roof. A lot of thought went into the design of it, almost some artistry put into it. A lot of people like [the] wood panelling, I like it. It's a beautifully crafted room.

Student: The way it is set up, you walk into a classroom that looks like a movie theatre, and I think people enjoy that. It's not like a high-school classroom ... Now you're in university and you have this cool lecture hall. The first day that I walked into this room... I was, like, wow, this is really big, but it's also really cool.

In PE275, the perception was different. As one student said, "it has slightly less appeal than 250. That's because of the colour of the walls. It would be nice to see the walls a different colour. It is very white, very stark." Another student expressed that in PE250, he "like[d] how the beams are and the ceiling and the wooden panels, more professional. In 275, it looks drab and boring."

Student: PE275 I have found that the room is very white. Although you don't want a lot of colour in room but it is very much White walls, white ceilings ... nothing super aesthetically pleasing about the room at all. It draws your focus to the front because there is nothing else interesting to look at so that's nice. But it's really boring ... 250 I think it's newer, or that's how it looks to me. It has the wood, it has a natural element, ... skylight ... a better environment. It is my natural preference just because it has something more than just your plain white walls and white ceiling.

#### **5.4.2 Furniture**

Students generally considered the chairs "decent", and appreciated that the backrests had some give. In both rooms, students had some concerns about the space, as they mentioned there was no room for crossing your legs, finding enough space when you come in late, or trying to leave during class. This was a bigger issue in PE275. One participant described that if she/he had "a textbook and notebook laid out, [she/he was] always into the next person's space," and another said "you are bumping elbows with everyone else." In PE250, only one student mentioned, "if you have a binder, and everyone beside you has a binder, it feels a little bit squished." When asked about one thing to change in the room, students in both PE275 and PE250 mentioned their space concerns: "Maybe deeper tables. If you wanted to follow along in your textbook, it would be hard to find room to do that."

Student: The only other problem I have noticed is that the desk height, it's an average height, but if you cross your legs, and you are taller you will hit the desks. And you can only move forward so much if people try to move behind you. If someone is trying to get in, it's difficult because the legroom space is only so deep. If you're just sitting, you usually have enough room width wise, a laptop and a notebook. But the length away from you can sometimes be tight.

### 5.4.3 Overall Layout

Students generally liked the shape of, amount of space in, and furniture configuration of PE250. Comments pertained to the semicircular layout of the room, the ceiling height, and the tiering. They thought the room looked professional and inviting. The layout of PE275, however, was described as suboptimal, ranging from the lack of ceiling height, providing a closed-in feeling, to the cramped, squished seats. Because the wings were straight, they were considered more removed from the professor. The lack of outer aisles in the room was also lamented, which led to congestion and distraction. The stairs were said not to stagger as well as in PE250. Students also generally disliked the removed feeling they got from having to sit in the back in both rooms.

## 6. Summary

### 6.1 PE250

All focus group participants generally liked PE250. They emphasized that for its function as a large lecture theatre, it was a good room. Student expectations about learning activities in this room were that classes would be primarily lecture classes. Class discussion was limited, but worked relatively well when it occurred, with the caveat that students had trouble hearing other students' comments or questions. Students preferred when the instructor was wearing a microphone. Students complained about noise from the doors slamming shut. All physical and technological aspects of the room seemed to work very well in the front half of the room, but acoustics and sightlines to the whiteboard specifically worked less well in the back half of the room. While the ceiling height was generally appreciated, students remarked that the rows could have wider spacing with desks of a greater depth. Students liked the way the room was tiered and its semicircular shape. This layout was said to aid in engagement and discussion. Further, students appreciated the thought that was put into the design of the room, including the wood panelling and the skylights. Natural light in particular seemed important to students, but they liked all of the lighting in the room. Whereas some students severely disliked the large class size, some others were less concerned with it.

### 6.2 PE275

While focus group attendees thought PE275 served its function as a large lecture theatre relatively well, they did not speak of PE275 as highly as of PE250. The main problems with the room were (a) the patchy lighting and the general darkness of the room, (b) the location of the projection screen and the resulting poor sightlines to the board, and (c) the crowdedness of the room, including the single entrance/exit door. Similar to PE250, acoustics from the back half or the wings were described as poor. Another problem was that the instructor microphone was not working 75% of the time and students in fact felt removed from the instructor. Students complained about noise from the doors slamming shut. Further, the row spacing was described as suboptimal in PE275. Aesthetics were also described as boring and the walls as too white. A final concern about PE275 was that the air was stuffy and the temperature inconsistent. As with PE250, whereas some students severely disliked the large class size, some others were less concerned with it.

## 7. Recommendations

Based on the student survey and focus group data presented here, the following recommendations for future large lecture spaces can be made to ensure an effective learning environment for students.

### 7.1 Room Layout

In the large lecture theatres, the semicircular shape of PE250 and its steeper tiering were preferred to the straight facing rows and shallow tiering in PE275. Further, row spacing and desk depth in both rooms was described as insufficient, which should be considered in the future. Going forward, a similar layout to PE250 should be considered for large lecture theatres. The effects of this room configuration seem to be intrinsically tied to acoustics, sightlines, and interaction, the aspects discussed next.

### 7.2 Acoustics

The acoustics in the back of the rooms were worse than in the front of the rooms. Overall, acoustics in PE250 were better than in PE275. The instructor was well heard when wearing a microphone. The back-to-front axis was acoustically poor in both rooms. Future considerations should pertain to sound-enhancing features in the room so that student comments and questions can be heard by other students and the instructor.

### 7.3 Sightlines

Sightlines in PE250 were described as excellent, with the small caveat that not all writing on the whiteboard could be seen from the back of the room. In PE275, sightlines to the board and projection screen were inferior from many seats in the front, especially on the wings, and from most seats in the back of the room, especially in the centre section.

### 7.4 Interaction/Engagement

The room layout of PE250 was further described as facilitating interaction among students and between students and the instructor. Students explained that the semicircular shape allowed them to be focussed and engaged. That was not the case in PE275. Future considerations should pertain to designing rooms in a manner that is conducive to student interaction and engagement, including sightlines to other students, visibility of materials, and ability to hear the instructor and course content.

### 7.5 Lighting

Lighting was another physical aspect that was mentioned often by students. Students liked that PE250 had some indirect natural lighting and preferred the entire lighting in the room much to that in PE275. The lighting in PE275 was described as dark, patchy, and inadequately controlled. Lighting is an important aspect in the learning environment, as students need to be able to see their notes as well as the course content. Attention must be paid to how the lighting is set up in classrooms. PE250 should be used as a better example.

## 8. References

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*, 77-101.

## 9. Appendix A: Student Survey

Student Survey – Page 1/2

Please fill in all answers on the SCANTRON sheet.

For questions **Q1-5**, please fill in the number that corresponds to your answer.

**Q1:** Please indicate your gender:

① = Female    ② = Male

**Q2:** Please indicate your age:

① = 17-21    ② = 22-26    ③ = 27-31    ④ = 32-35    ⑤ = older than 35

**Q3:** Please indicate your year of study:

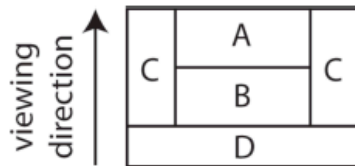
① = Year 1    ② = Year 2    ③ = Year 3    ④ = Year 4    ⑤ = Other

**Q4:** Generally, how do you feel about **THIS** classroom as a learning space?

① = I hate it    ② = I don't like it    ③ = Neutral    ④ = I like it    ⑤ = I love it

**Q5:** Where approximately do you usually sit in this classroom? Answer based on the graphic below.

① = A    ② = B    ③ = C    ④ = D    ⑤ = I don't have a usual spot.



Please rate your level of agreement for questions **Q6-9**.

**THIS classroom:**

**Q6:** Is an effective space in which to hold this particular course

① = Strongly Disagree, ② = Disagree, ③ = Agree, ④ = Strongly Agree

**Q7:** Facilitates different types of learning activities (lecture, discussion, group work)

① = Strongly Disagree, ② = Disagree, ③ = Agree, ④ = Strongly Agree

**Q8:** Offers a physically comfortable learning environment

① = Strongly Disagree, ② = Disagree, ③ = Agree, ④ = Strongly Agree

**Q9:** Facilitates my engagement in the learning process

① = Strongly Disagree, ② = Disagree, ③ = Agree, ④ = Strongly Agree



Student Survey – Page 2/2

Please rate your level of satisfaction for questions Q10-18.

**How do you feel about the following aspects of THIS classroom as a learning space for this course?**

**Q10:** Lighting at my desk

① = Very Dissatisfied, ② = Dissatisfied, ③ = Satisfied, ④ = Very Satisfied

**Q11:** Lighting at the front of the room

① = Very Dissatisfied, ② = Dissatisfied, ③ = Satisfied, ④ = Very Satisfied

**Q12:** The ability to hear instructor

① = Very Dissatisfied, ② = Dissatisfied, ③ = Satisfied, ④ = Very Satisfied

**Q13:** The ability to hear course content

① = Very Dissatisfied, ② = Dissatisfied, ③ = Satisfied, ④ = Very Satisfied

**Q14:** Noise level (the presence of distracting noise)

① = Very Dissatisfied, ② = Dissatisfied, ③ = Satisfied, ④ = Very Satisfied

**Q15:** Room configuration (layout of the room)

① = Very Dissatisfied, ② = Dissatisfied, ③ = Satisfied, ④ = Very Satisfied

**Q16:** Furniture (quality and comfort of chairs, desks)

① = Very Dissatisfied, ② = Dissatisfied, ③ = Satisfied, ④ = Very Satisfied

**Q17:** Sight lines (the ability to see the instructor and course content)

① = Very Dissatisfied, ② = Dissatisfied, ③ = Satisfied, ④ = Very Satisfied

**Q18:** Wall colour

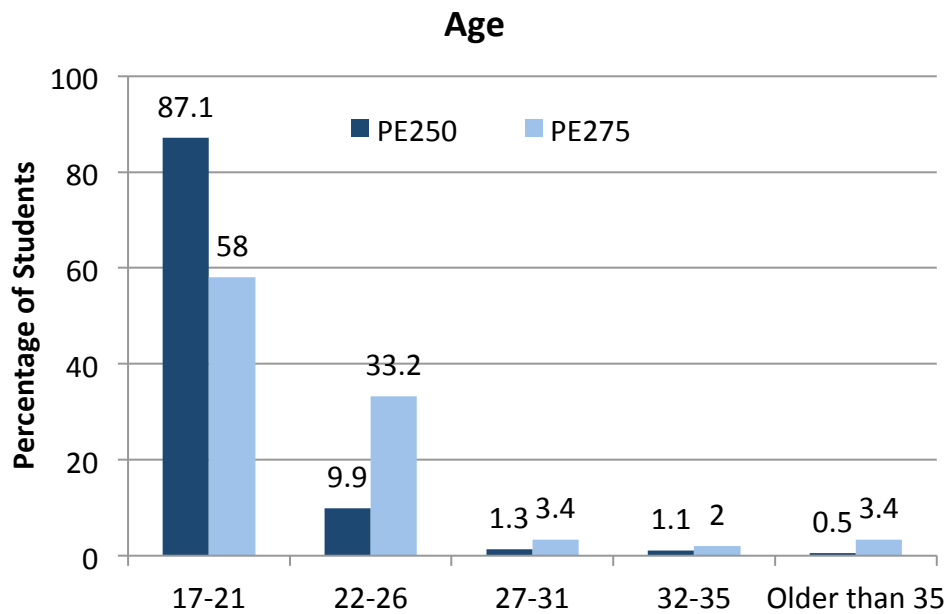
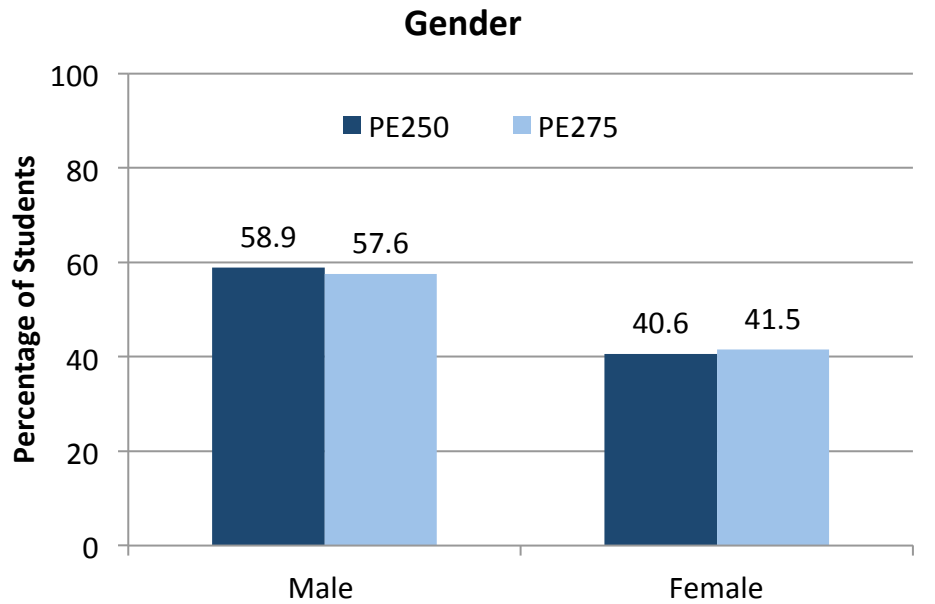
① = Very Dissatisfied, ② = Dissatisfied, ③ = Satisfied, ④ = Very Satisfied

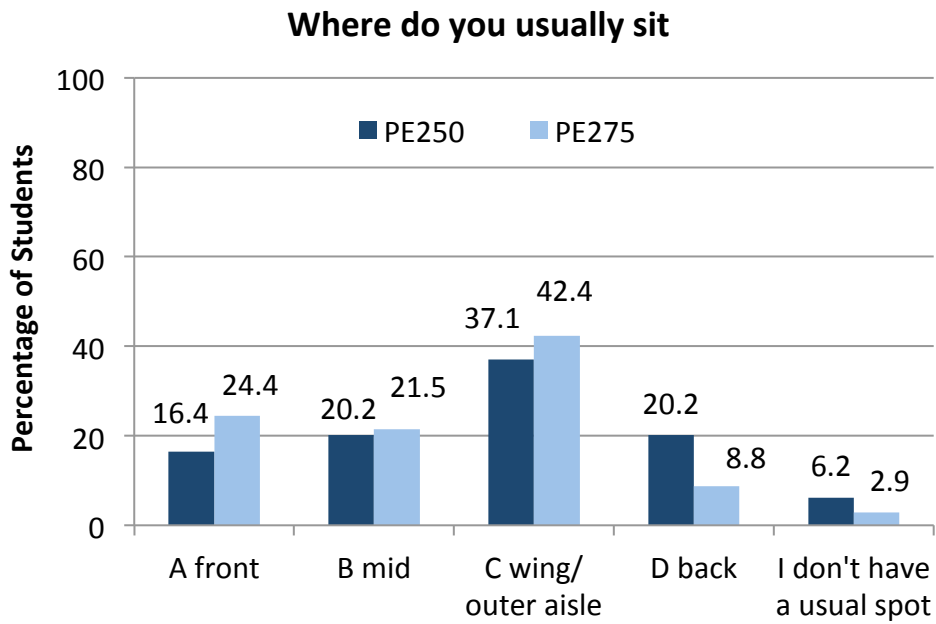
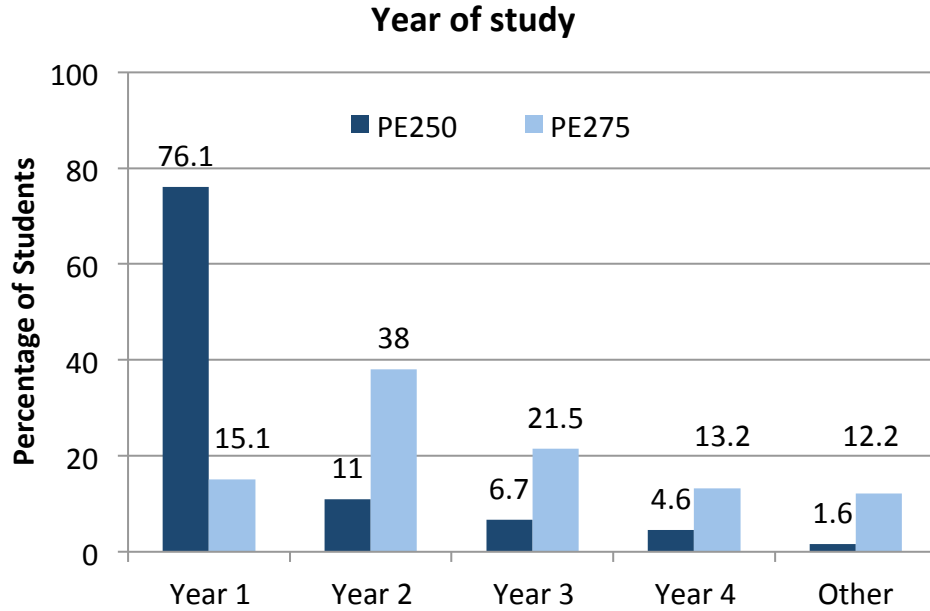
**If you have any additional comments, please sign up for one of the upcoming focus group sessions to be announced soon!**

## 10. Appendix B: Survey Data

This appendix contains the student survey data of items rated on agreement and satisfaction, as well as demographic information. Previously displayed results are not displayed again here.

### 10.1 Demographics

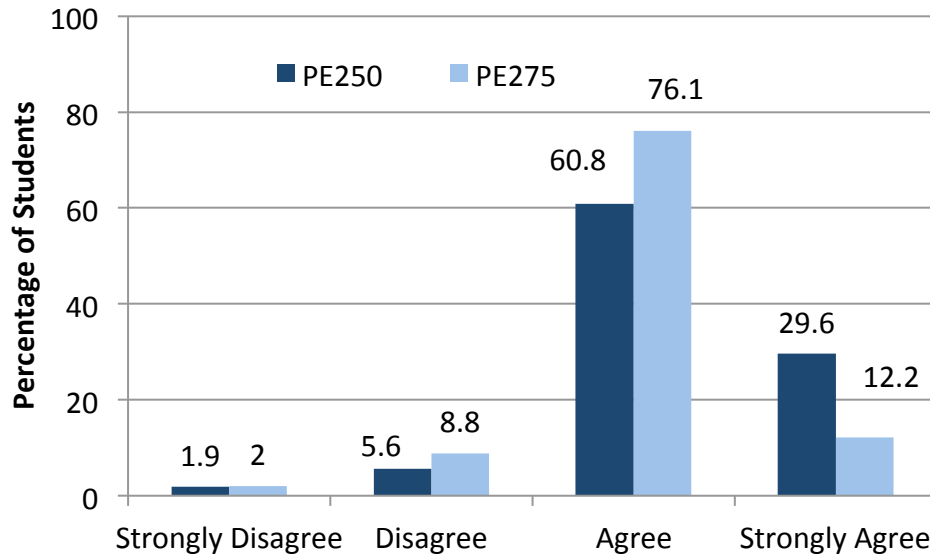




## 10.2 Learning Environment

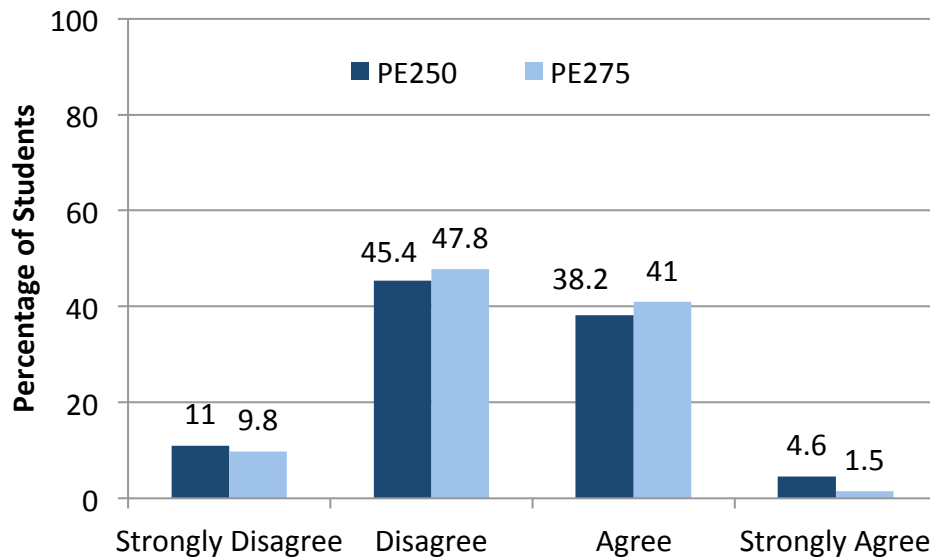


**Effective space in which to hold this course**

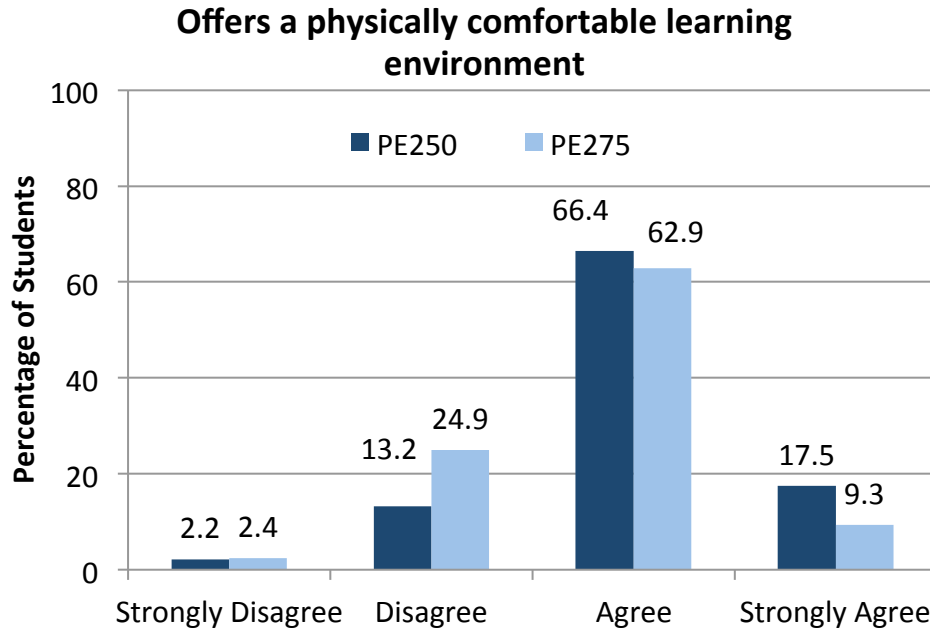


Students in PE250 ranked the room higher as an effective teaching space (mean rank = 302.95) than students in PE275 (mean rank = 250.03),  $U = 30050$ ,  $Z = -4.47$ ,  $p < .001$ .

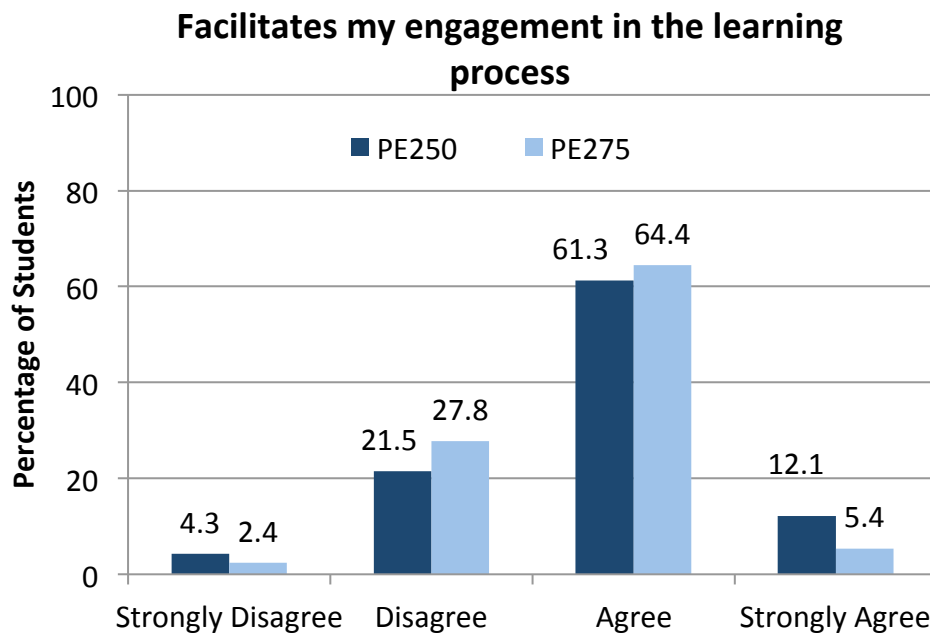
**Facilitates different types of learning activities**



Students in PE250 (mean rank = 288.66) and students in PE275 (mean rank = 285.41) ranked the rooms equally high on the question whether the room facilitated different types of learning activities,  $U = 37394.5$ ,  $Z = -0.25$ ,  $p = .81$ .

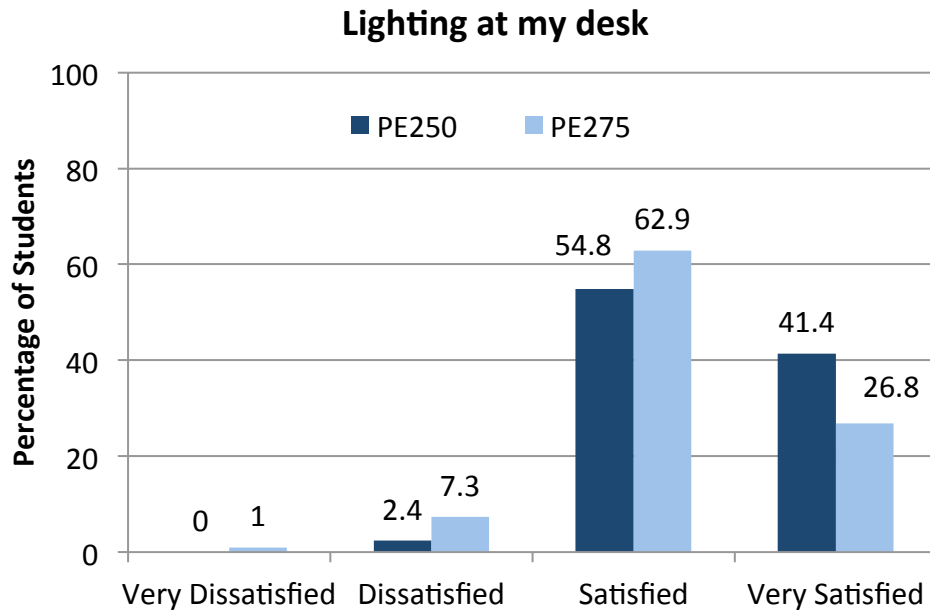


Students in PE250 ranked the room higher in physical comfort (mean rank = 304.03) than students in PE275 (mean rank = 256.2),  $U = 31355.5$ ,  $Z = -3.93$ ,  $p < .001$ .

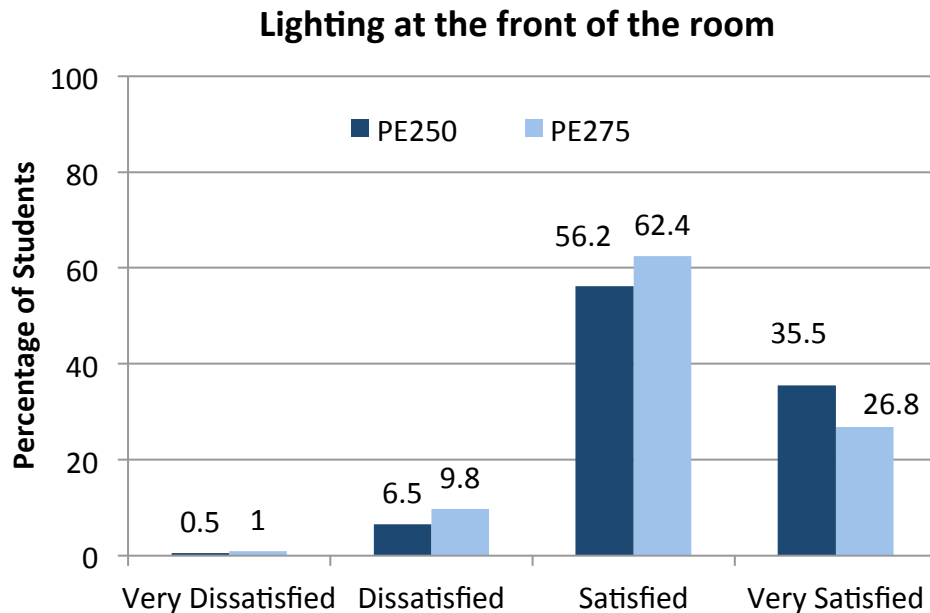


Students in PE250 (mean rank = 369) and students in PE275 (mean rank = 272.58) ranked the rooms equally high on the question whether the room facilitated engagement in the learning process,  $U = 34763.5$ ,  $Z = -1.87$ ,  $p = .06$ . Note, however, that this difference showed a trend toward significance.

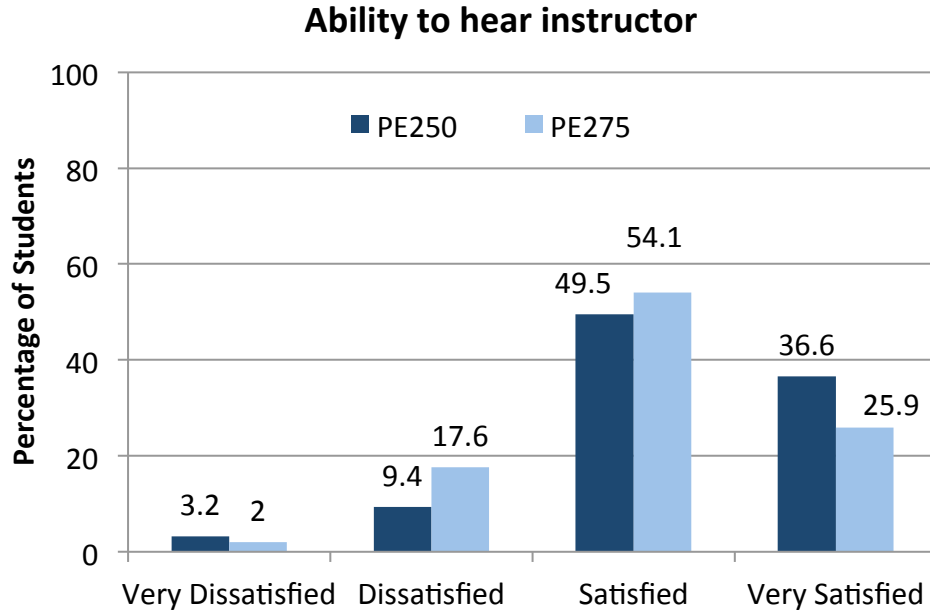
### 10.3 Physical Aspects



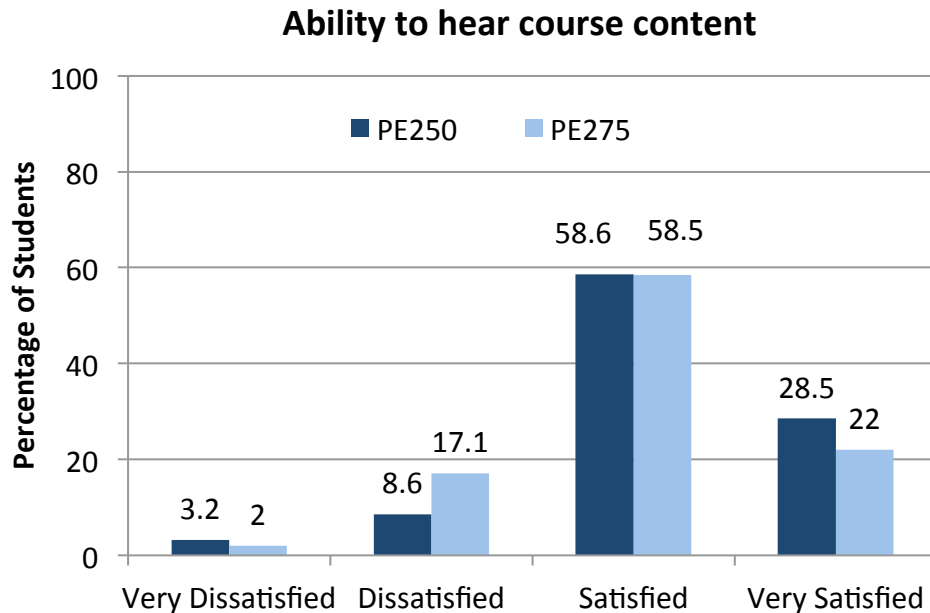
Students in PE250 ranked the lighting at their desk higher (mean rank = 302.43) than students in PE275 (mean rank = 251.93),  $U = 30336.5$ ,  $Z = -4.05$ ,  $p < .001$ .



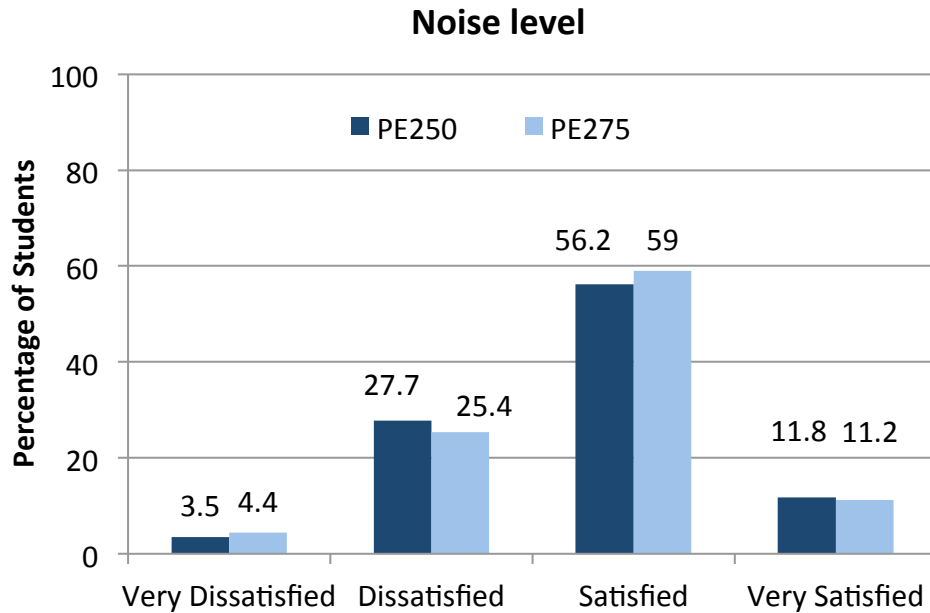
Students in PE250 ranked the lighting at the front of the room higher (mean rank = 302.43) than students in PE275 (mean rank = 266.61),  $U = 33541$ ,  $Z = -2.47$ ,  $p = .001$ .



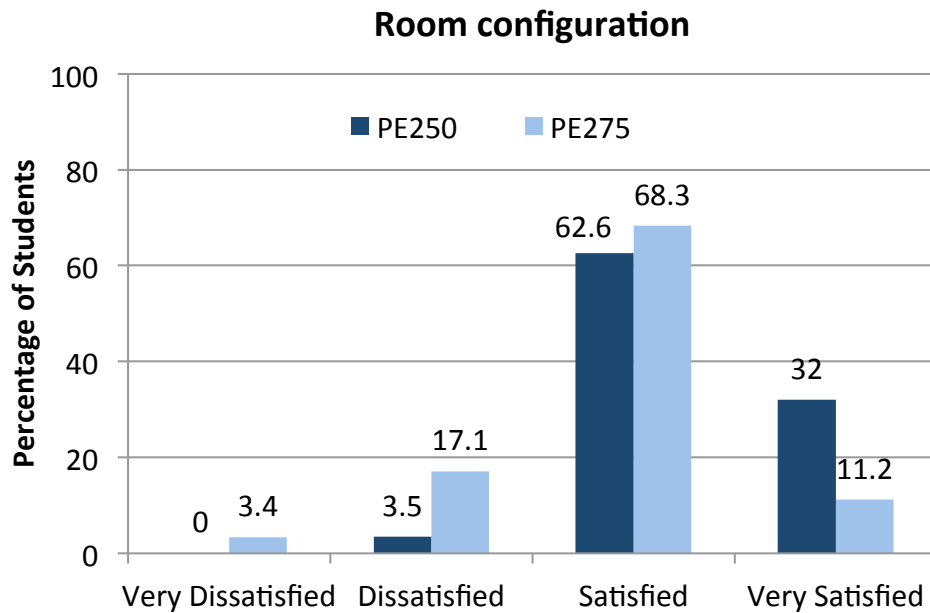
Students in PE250 ranked their ability to hear the instructor higher (mean rank = 299.82) than students in PE275 (mean rank = 261.14),  $U = 32362$ ,  $Z = -2.96$ ,  $p < .001$ .



Students in PE250 ranked their ability to hear course content higher (mean rank = 297.36) than students in PE275 (mean rank = 266.91),  $U = 33539$ ,  $Z = -2.4$ ,  $p = .002$ .

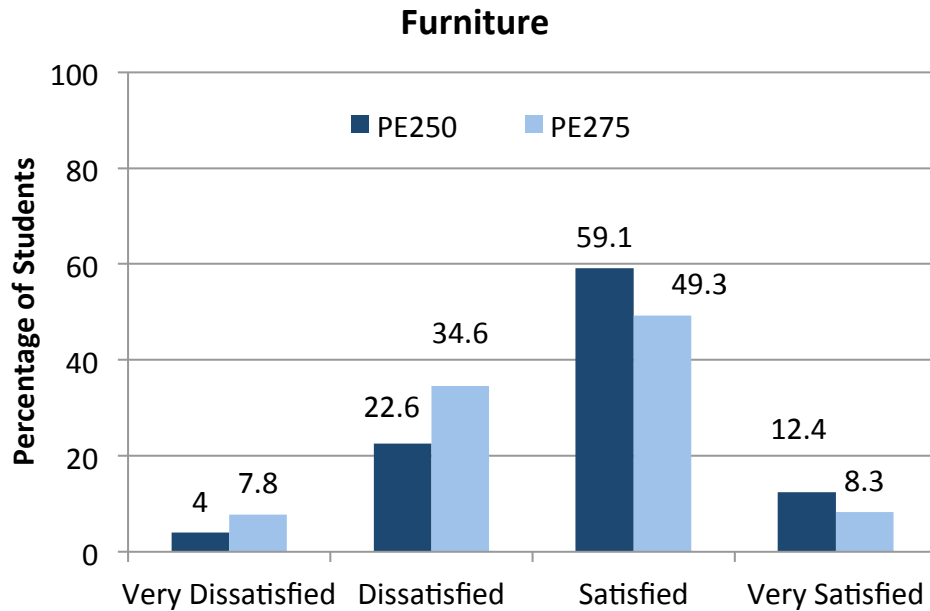


Students in PE250 (mean rank = 286.82) and students in PE275 (mean rank = 288.73) ranked the rooms equally high on noise level,  $U = 37571$ ,  $Z = -0.15$ ,  $p = .88$ .

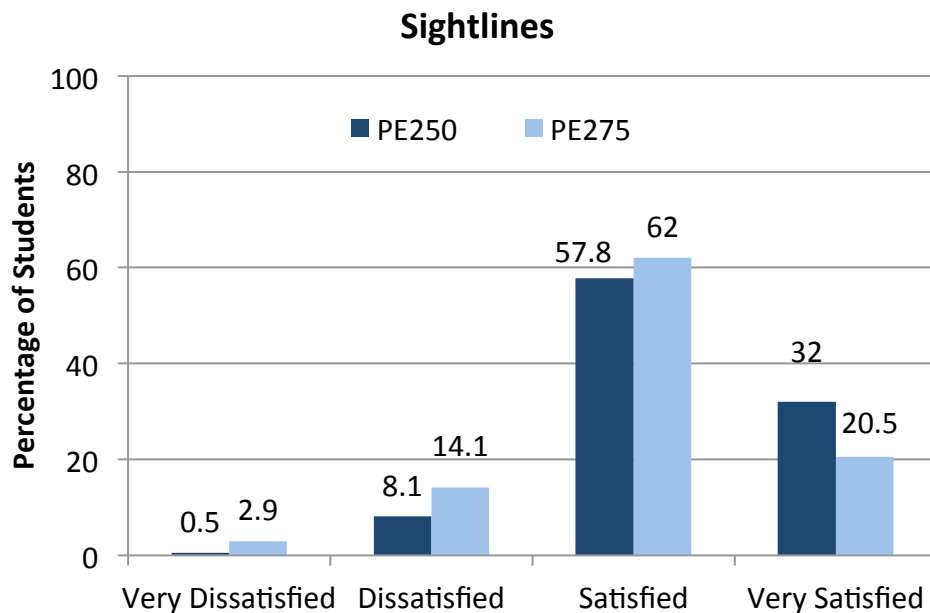


Students in PE250 ranked the room configuration higher (mean rank = 318.45) than students in PE275 (mean rank = 226.82),  $U = 25384$ ,  $Z = -7.6$ ,  $p < .001$ .

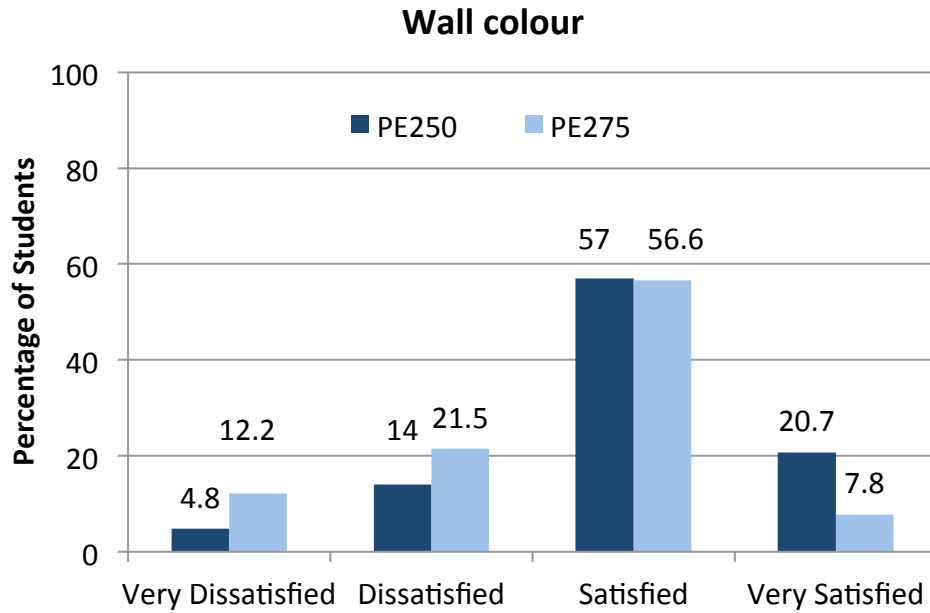




Students in PE250 ranked the furniture higher (mean rank = 302.82) than students in PE275 (mean rank = 254.66),  $U = 31090$ ,  $Z = -3.75$ ,  $p < .001$ .



Students in PE250 ranked the sightlines higher (mean rank = 302.56) than students in PE275 (mean rank = 254.89),  $U = 31088.5$ ,  $Z = -3.8$ ,  $p < .001$ .



Students in PE250 ranked the wall colour higher (mean rank = 303.83) than students in PE275 (mean rank = 238.84),  $U = 27705$ ,  $Z = -5.13$ ,  $p < .001$ .