The Perceptions of Students About PowerPoint As a Teaching Tool in College-Level Introductory Biology Classes

By

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Abstract

Instructive technology such as PowerPoint is considered commonplace in university classrooms. While the need for a visual tool for communication is clear, there is a difference in students' and professors' perceptions of PowerPoint and its usefulness as that tool. Though there is a fair amount of data on the perceptions of PowerPoint as a whole and the effectiveness of PowerPoint in comparison to other lecturing and visual aid types, there is little research that pertains specifically to Biology classes, especially entry-level courses for students majoring in Biology. This study looked at students enrolled in Biology classes at Middle Tennessee State University and found that as the number of classes taken in the major increase, positive opinions toward PowerPoint decrease and students perceive professors to be more prepared when using PowerPoint.

Introduction

Instructive technology, particularly PowerPoint, is commonplace in many university classrooms (Parker *et al.*, 2008). While its use was still being debated, it's currently considered a standard in educational settings (Szabo & Hastings 2000; Parker *et al*., 2008; Thielsch & Perabo, 2012). Though its use in classrooms is now widely accepted, its effectiveness is still being assessed. While some previous research has shown that PowerPoint presentations, with a pertinent graphic content, can be useful to students, other studies have found no significant difference in performance scores between those who were shown PowerPoint presentations and those taught using traditional lecture techniques (Buchko *et al*., 2012; Savoy *et al*., 2009; Mackiewicz, 2008; Susskind 2005; Apperson *et al*., 2006).

While the effectiveness of PowerPoint is under ongoing investigation and debate, visual components in general are becoming increasingly in demand in classrooms. The use of these components has increased sharply in the field of biology, due to their effectiveness in conveying complex biological concepts (Taylor 2010). More and more students are claiming to be visual learners, making the need for an effective way to communicate and display graphics crucial (Taylor 2010). Many teachers use PowerPoint as the way to fulfill this need for a visual aid in classrooms (Apperson 2006).

While the need for a visual tool for communication is clear, there is a difference in students' and professors' perceptions of PowerPoint and its usefulness

as a visual tool. Previous research has shown that students typically have an overall positive view of PowerPoint and the majority of students believe that PowerPoint presentations make professors appear more prepared and keep students' attention better (Frey & Birnbaum 2002; Susskind 2005). Studies that have monitored faculty response to PowerPoint have yielded mixed results; some show that faculty members prefer transparency slides or whiteboards for lecture purposes, while others felt PowerPoint was able to deliver lecture information with increased clarity (Parker *et al.*, 2008; Gupta 2011; Nicholson, 2002). People's perceptions, or as many would call it, their view of what reality is, have been shown to impact behavior (Reimann & Bechara, 2010). There are many variables that can impact perceptions and the differences between these groups of students and professors. These perceptions held by individuals could translate into different outcomes in the classroom, for example, into performance on tests, class participation and overall success based on the perception of whether or not the course is valuable.

There is a fair amount of data on the perceptions of PowerPoint as a whole and the effectiveness of PowerPoint in comparison to other lecturing and visual aid types, but there is little research that pertains specifically to Biology classes, especially entry-level courses for students majoring in biology (Susskind, 2005; Apperson, 2006; Mackiewicz, 2008; Apperson, 2008). There is also little research in the area of contrasting perspectives on PowerPoint between different Biology education levels (amount of biology classes a person has been exposed to). The overall goal of this study was to compare the perceptions of Biology students on the use of PowerPoint in introductory biology classrooms in higher education. The

specific objectives were to determine, using the factors of gender, age, degree status, years of personal use of PowerPoint, and years of classroom use of PowerPoint, if there were differences among 1)Biology 1110 students 2) Biology 1120 students 3) Biology 4200 students and 4) determine, using the factors of 18-25 year olds only, if there were differences between class standing, genders, and the combination of class standing and gender.

Materials and Methods

Design of Research

A Likert survey was used because of the descriptive nature of the project. The Likert scales went from "Strongly Disagree," which was assigned a score of 1, to "Strongly Agree," which was assigned a score of 7. Thirteen Likert scale questions were used along with four questions over a series of PowerPoint slides and six questions asking demographic information (Appendix A). The Likert questions focused on overall themes: student learning and the correlation of PowerPoint to grades, what type of slides were most effective for communicating Biological concepts, and how PowerPoint should be used by instructors. Surveys were reviewed by the University's IRB and, after being given approval (IRB #15-028), were distributed to each individual class as a paper survey.

Participants

The participants in the survey comprised 599 students from Middle Tennessee State University who were all enrolled in Biology classes for majors. Surveys were

distributed to five sections of Biology 1110, three sections of Biology 1120, and three sections of Biology 4200. These were chosen because Biology 1110 and 1120 are the introductory Biology classes for majors and Biology 4200 is the senior seminar class all Biology majors are required to take before graduation. There were 456 students surveyed from Biology 1110 courses (190 male and 266 female), 93 students from the 1120 courses (43 male and 50 female), and 50 students from the 4200 courses (15 male and 35 female). Overall, there were 248 males and 351 females. All surveys were distributed during first 2 weeks of classes in the fall of 2014.

Experimental Design

The goal of objectives 1-3 was to compare perceptions of PowerPoint within individual classes. The following factors were analyzed for each class: gender, age, degree status, years of personal PowerPoint use, and years of classroom use of PowerPoint. For gender, two qualifications were compared: male and female. For age, the qualifications were: 18-25, 26-30, 31-35, 36-40, 41-44, 45-50,51-55, and 55+. For degree status, the qualifications were: <30 credit hours, 30-59 credit hours, 60-89 credit hours credit hours, 90+ credit hours, Masters, PhD, and faculty. For years of personal PowerPoint use, the qualifications were: <1 year, 1-2 years, 2-3 years, 3-4 years, 4-5 years, and 5+ years. For years of classroom use of PowerPoint, the qualifications were: <1 year, 1-2 years, 2-3 years, 3-4 years, 4-5 years, and 5+ years.

The goal of objective 4 was to compare perceptions of PowerPoint among 18-25 year olds. The factors analyzed were: gender, class, and gender and class. For

gender, the two qualifications were male and female. For class, the qualifications were: Biology 1110, Biology 1120, and Biology 4200. For gender and class, the qualifications were: Biology 1110 Females, Biology 1110 Males, Biology 1120 Females, Biology 1120 Males, Biology 4200 Females, and Biology 4200 Males. Raw mean and standard deviations values are in Appendix B and C.

Statistics

For all four objectives, the factor of gender was analyzed using a 2-tail T-test. All other factors for all objectives were analyzed using one-way analyses of variance with Tukey's post hoc tests. All analyses were performed using JMP Pro 9 software. Significant differences were defined by p values < 0.05.

Results

Biology 1110 Only Results (Objective 1)

In Biology 1110 classes, major discrepancies were observed when comparing gender, degree status, and age (Table1.1, 1.2, 1.3, 1.4, 1,5). With respect to gender, questions 8 (*I think professors should spend less time using PowerPoint slides*) and 13 (*PowerPoint use during lectures is, in my opinion, the most efficient form of communicating course content*) showed a statistically significant difference between the genders. Question 8 showed both genders in disagreement with the statement and both means below 3.0. Question 13 showed both genders in agreement with the statement with means over 5.0.

With respect to degree status, there were significant differences on questions 4 (*I prefer PowerPoint slides with only key terms and definitions written out*) and 8. Question 4 showed a difference between students with 90+ credit hours (3.5) and those with less than 30 (4.3). Question 8 had disagreement with the statement from all qualifications except for PhD (4.0), and those with a masters degree had the lowest average at 2.0.

When examining age, question 6 (*PowerPoint makes instructors look more prepared for their lecture*) was the only question that showed a significant difference between qualifications. While all ages were in agreement with the statement the mean of the qualification of 31-35 was the lowest with 4.5 and 41-45 year olds had the highest at 7.0.

Biology 1120 Only Results (Objective 2)

Significant differences with respect to gender were observed for five questions (Table 2.1). For questions 1 (*I find visual elements such as pictures, diagrams, and graphs the most useful for student learning in PowerPoint presentations*), 5 (*PowerPoint use during lectures is the most effective form of communicating course content*), 6, 12 (*The use of PowerPoint in classroom instruction leads to better student grades on exams and final course grades*), and 13, males had a statistically significant lower mean than females. On all questions, both genders agreed with the statements, but males agreed to a lesser extent. Students of both genders agreed with question 11 (*The utilization of PowerPoint is useful in increasing student learning in the classroom.*) with males having a higher average (5/6) over females (5.1).

No significant differences were observed when age, degree status, years of PowerPoint usage and years of PowerPoint use in a classroom setting was analyzed (Tables 2.2, 2.3, 2.4).

Biology 4200 Only Results (Objective 3)

Significant differences were only observed for differences in years of personal use of PowerPoint and years of classroom use of PowerPoint (Tables 3.2, 3.3).

For years of personal use, significant differences were observed for questions 6 and 13. With both questions, those with 5+ years of PowerPoint usage agreed with the statements more strongly. For question 6, those with 2-3 and 4-5 years experience disagreed, while those with <1 year, 1-2 years, 3-4 years, and 5+ years experience agreed to varying extents. For question 13, those with <1 year, 2-3 years, and 4-5 years disagreed and those with 1-2, 3-4, and 5+ years agreed.

With respect to classroom use, the only question with a significant difference between groups was question 12. Those with <1 year of PowerPoint instruction disagreed that PowerPoint leads to higher student grades, while those with 5+ years of experience agreed.

Ages 18-25 Only looking at Class (Objective 4)

When looking at exclusively 18-25 year old students within three classes (BIOL 1110, 1120, 4200), there were significant differences on questions 5, 6, 7 (*PowerPoint effectively captures students' attention*), 8, 9 (*I personally find classroom instruction less engaging when PowerPoint slides are read verbatim by the*

speaker), 11 (*The utilization of PowerPoint is useful in increasing student learning in the classroom*), and 13 (Tables 4.2, 4.4).

For questions dealing with student learning and attention (questions 5, 7, 11, and 13), class averages for all three classes showed agreement with each question. For question 5, however, the Biology 4200 class had an average of 4.4, while both of the lower classes had an average of over 5.0. For Question 7, though all averages were over 4.0, significant differences were observed, with Biology 4200 having the lowest average and Biology 1110 having the highest. For question 11, all classes were in agreement with the lowest average (Biology 4200) being 4.9. For question 13 Biology 1110 (5.2) and 1120 (5.2) classes were not statistically significant from one another, but they were both statistically different from Biology 4200 class (4.4).

Questions 6, 8, and 9 dealt with the professor's role in the classroom, including how prepared they looked and what stylistically the student preferred on slides. For question 6, all classes agreed that a professor looked more prepared when they used PowerPoint with the 1110 class having the highest average at 5.4 compared to Biology 1120 (5.3) and Biology 4200 (4.7). For question 8, all classes disagreed with the statement; again the 4200 class had the highest average at 3.5 compared to Biology 1110 (2.7) and Biology 1120 (3.07). Question 9 had agreement from all classes with the 4200 class having the highest average at 5.9 compared to Biology 1110 (4.8) and Biology 1120 (3.1).

Ages 18-25 Only looking at Gender

When all students ages 18-25 were grouped together by gender regardless of class, it showed significant differences for questions 1, 5, 6, 8, 12, and 13 (Tables 4.1, 4.5).

Questions 6 and 8 are on the topic of the role of a professor. For question 6, both genders agreed, but females had a significantly higher average of 5.5 compared to a male average of 5.2. Question 8 showed disagreement from both genders; females disagreed more strongly with an average of 2.6 compared to the male average of 3.0.

Questions 5, 12, and 13 were about PowerPoint as a teaching tool. Students from both genders agreed that PowerPoint was an effective teaching tool, per question 5, and that it led to better student grades, per question 12. For both topics, females had a statistically higher average. Question 13, which talks about the efficiency of PowerPoint as a teaching tool, again showed both genders agreeing but with a higher average from females.

Question 1 showed that students find visual elements on a PowerPoint slide the most useful. Females had a significantly higher average (6.1), but males also strongly agreed (5.9).

Ages 18-25 by Gender and Class

Finally, students 18-25 were analyzed by class and gender. This yielded statistically significant results on questions 5, 6, 8, 9, and 13 (Tables 4.3, 4.6). Each

of these questions focused on with either the professors' usage and presentation of PowerPoint or PowerPoint as a teaching tool.

Questions 6, 8, and 9 were on the topic of the professor's role with PowerPoint. For question 6, all categories agreed; however, the biggest difference in averages came from Biology 1110 and 1120 females and Biology 4200 females. Biology 1110 females (5.5) and Biology 1120 females (5.6), were not significantly different from each other, but both were significantly different from Biology 4200 females (4.5). Question 8 had averages below 4.0 for all categories, with significant differences between Biology 1110 females (2.5) and Biology 4200 males (3.9) and Biology 1120 females (2.9) and Biology 4200 males (3.9).For question 9, all categories agreed that classroom instruction is less engaging when read verbatim by the speaker. For females, Biology 1110 had the lowest average (4.9) and that increases for Biology 1120 (5.3) and Biology 4200 (6.0) with Biology 1110 and 4200 being significant from one another. For males, Biology 1110 had the lowest average (4.7) and that increased for Biology 1120 (5.9) and Biology 4200 (5.7) with Biology 1110 and 1120 being significantly different from each other. Questions 5 and 13 asked about the efficiency and effectiveness of PowerPoint as a teaching tool. For question 5, females in 1110 and 1120 had the same average (5.6) and are not significant from 4200 (4.7). For males, there was an inverse trend between classes and average; Biology 1110 (5.3) is highest followed by 1120 (4.8) and 4200 (3.6).Question 13 had agreeing averages from all categories. Biology 1110 classes had the highest averages, while Biology 4200 classes had the lowest.

Discussion

A wealth of studies have studied PowerPoint as an instructional tool (Szabo & Hastings, 2000; Bartsch & Cobern, 2003; Nicholson, 2002). While it has been shown that students perceive PowerPoint as an effective tool for teaching in classrooms, data may show otherwise. While the present study did not look at student grades between traditional lectures and PowerPoint lectures, there is extensive data on this. Studies by Szabo and Hastings (2000) and Apperson, Laws and Scepansky (2006) showed that, while students perceived PowerPoint as more helpful for conveying information, the researcher found that grades did not reflect that. Both studies found there was no significant differences in test grades of students who attended traditional lectures and those who attended lectures supplemented by PowerPoint (Szabo & Hastings, 2000; Apperson *et al*., 2006). The study by Apperson (2006) looked at ten separate classes across five different disciplines, so these results are significant across subjects of study. A study by Savoy (2008) went one step further and looked at auditory retention between PowerPoint lectures and traditional lectures. They found that students preferred the PowerPoint lectures, but they retained less auditory information from them than traditional lectures (Savoy *et al*., 2009). As said by Wiebe et al., (2006), use of technology does not necessarily produce meaningful learning.

Despite the large number of studies on PowerPoint in general, very few if any have looked strictly at Biology students. In the present study, many of the questions for 18-25 year olds with significant differences in responses were between 1110 and 4200 classes or 1110 and 1120 classes differing with 4200 classes. This may be because students in introductory classes truly just get more out of presentations that

use PowerPoint or it may have to do with content. For Biology 1110 and 1120 students, this is either their first or second class in the major. Most of the information they have been given deals with an overview of Biology. Course content does not go into deep details and it may be easier to cover in a PowerPoint. Biology 4200 students have had many more Biology classes including upper-division classes. As classes go more in-depth, more professors may choose not to use PowerPoint or material may lend itself better to traditional styles of lecturing or use of whiteboards.

When looking at student perception of PowerPoint, the main question is whether students find it to be an effective teaching tool. The general agreement that students like PowerPoint seems to be a trend across a large number of studies (Szabo & Hastings, 2000; Bartsch & Cobern, 2003; Nicholson, 2002; Apperson *et al.*, 2006;Susskind, 2005;Thielsch & Perabo, 2012). Savoy looked at students' opinions between PowerPoint and traditional lectures and found that students thought that PowerPoint was more effective for remembering material (2009). In the current study, when looking at question 5 (PowerPoint use during lectures is the most effective form of communicating course content), all qualifications except the qualification of 18-25 year old males in the 4200 class, agreed that PowerPoint was most effective. While those males in 4200 did not agree, their average was 3.6 which is very close to a neutral 4.0. Studies have shown that males have less of an affinity for technology (Parker at al., 2008), but further studies to confirm why this outcome happened should be considered.

While the main objectives of the present study dealt with looking at significant differences between factors, there is one question to note that had no

differences. All factors and qualifications were in agreement, though to differing extents, that teachers look more prepared when they use PowerPoint slides (Question 6). This agrees with data found by Frey (2002) and Apperson (2006) who both reported students felt professors looked more prepared when using PowerPoint. This could be due to any number of reasons. Since PowerPoint is so user friendly, it allows presenters to easily compile all information needed and helps to eliminate the exclusion of information that can happen if a professor is giving a traditional lecture.

Powerpoint has been shown to be useful to students because it contains visual elements. Butchko *et al*., (2012) found that slides with words as well as pictures showed an increase in students' material retention. Students in this study also found they did not like slides with full sentence outlines. Likewise, students in this study also indicated that visual elements were helpful. A study by Mackiewicz (2008) also found students did not care for slides with too many lines or an overabundance of words.

According to Apperson (2006) students did not mind when professors read the entire content of slides. However, in the present study, while students felt PowerPoint makes professors more prepared, they also felt if the speaker reads slides verbatim that it is less engaging. This could be a personal preference or could have to do more with the content and construction of slides. If slides are very verbose and teachers have no outside content to contribute, it may be more tedious than if a professor uses bullet points and addresses the class with additional information as slides are shown. This may have to do with the nature of the content in Biology courses.

In the present study, it was shown that, in the 18-25 year old age range, students' opinion of PowerPoint decreased as they progressed through the classes in the Biology major. While both genders in the entry level course started with an overall average indicating agreement that PowerPoint was the most effective teaching tool, by the time those in the highest class were asked, they had a neutral or disagreeing average. Males also had a lower average than females, which agrees with a survey conducted by Parker *et al.*, (2008) that showed males viewed technology less favorably than females. While initially this may be surprising, it may be due to a difference in preference of learning style. As far as the average score lowering as students progress through classes, this could be for several reasons. Students are exposed to more classes and a variety of instructors as they progress through the major; they may find other teaching methods such as the use of whiteboards more effective. Some Biology content does not lend itself to the format of PowerPoint. Students in the 18-25 range are often entering college directly after high school as well. Some may come from backgrounds where PowerPoint was used frequently and it is a familiar teaching experience for them; on the other hand, some may come from schools where the technology was not used and it is a novel experience for them. Either one could help to explain why students lean toward PowerPoint as an effective tool in the lower classes but change their minds as they progress. More studies may need to be conducted to identify an exact reason for this outcome.

Conclusions

Overall, students in the 18-25 year old range had opinions that decreased about PowerPoint use in Biology classes as the number of major classes they took increased.

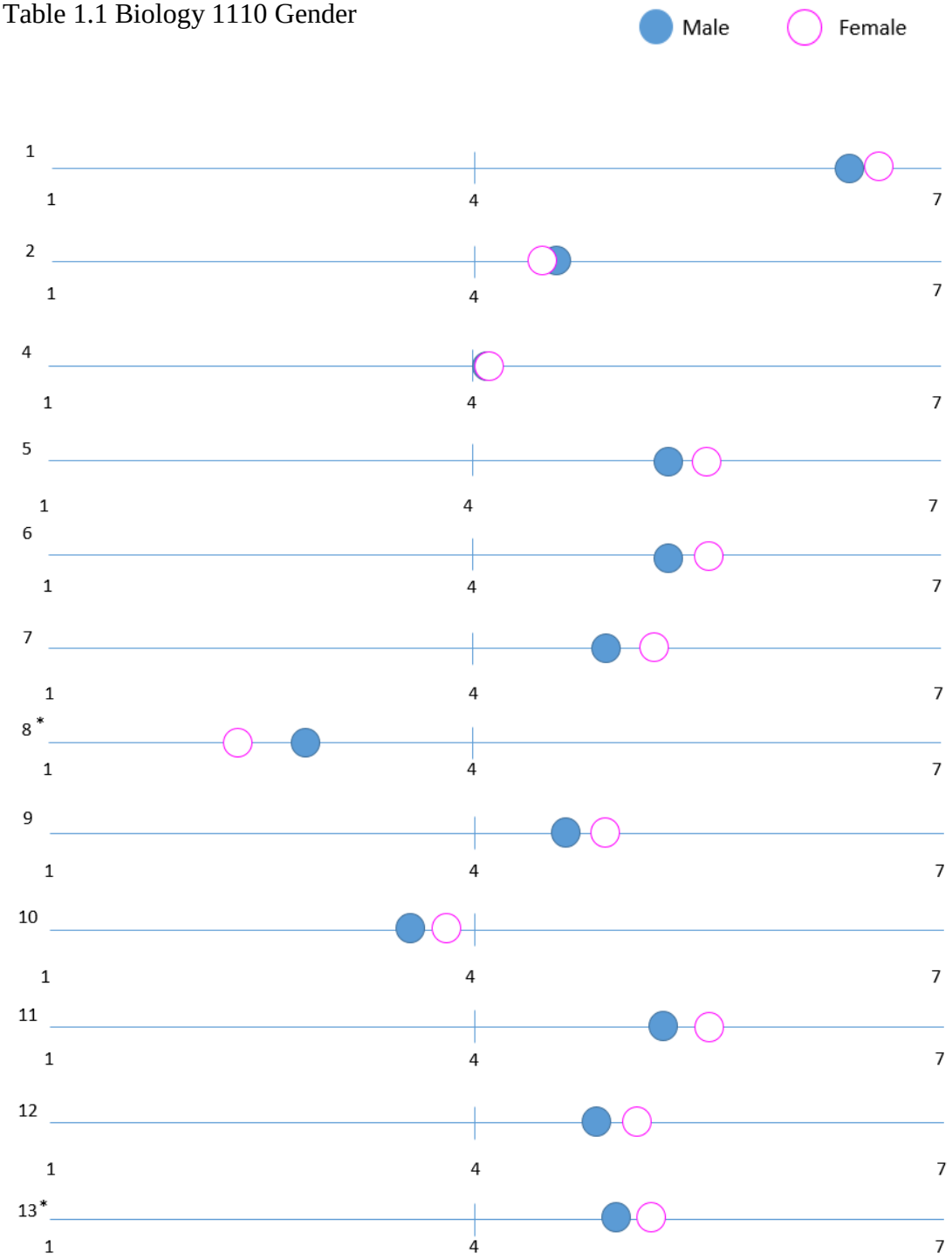
In the present study, students preferred PowerPoint over traditional lecture styles and they think professors looked more prepared when they used PowerPoint for presentations.

Future Studies

Going forward, more data should be collected to look at student learning and how it compares to student opinion on teaching tools such as PowerPoint to get a comprehensive look at perceptions of PowerPoint verses reality which is student retention and grades. We would also like to look at Biology professor's perceptions to see if there are any significant differences in opinion from that of students. The goal is to create a learning environment that promotes the highest level of student learning and effective communication from professors about course material. PowerPoint has become standard for many classrooms, especially with a heavy push for technology in classrooms. This may also work better for some major classes than others. Just because a technique works in Chemistry or the Humanities does not mean that is the most effective means for Biology classrooms; then again, it could be. We just want to make sure there are data to support decisions made by professors about content communication styles and that students are benefitting from the methods used in classrooms.

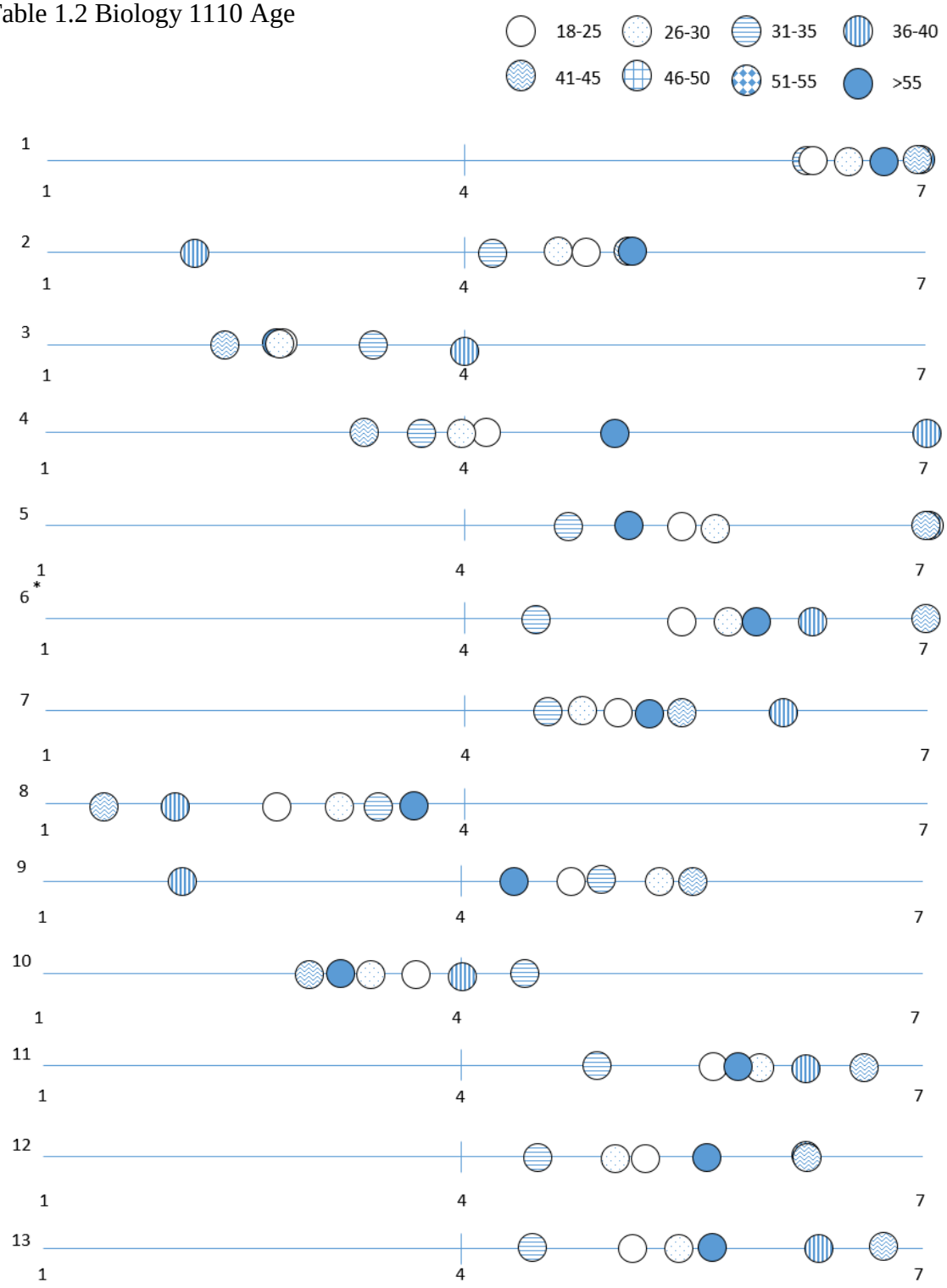
List of Figures

Table 1.1 Biology 1110 Gender



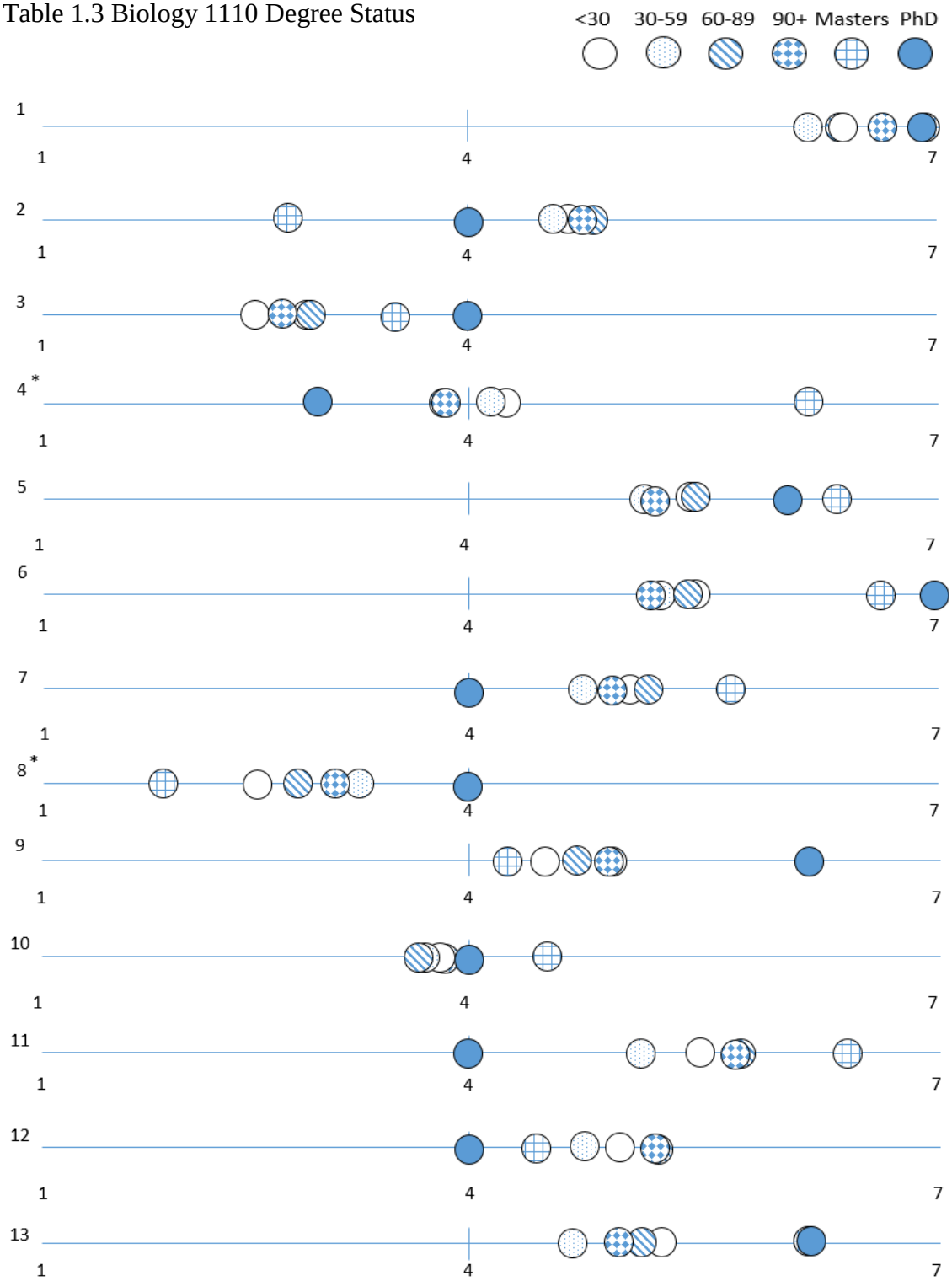
* denotes questions with significant differences ($p<0.05$)

Table 1.2 Biology 1110 Age



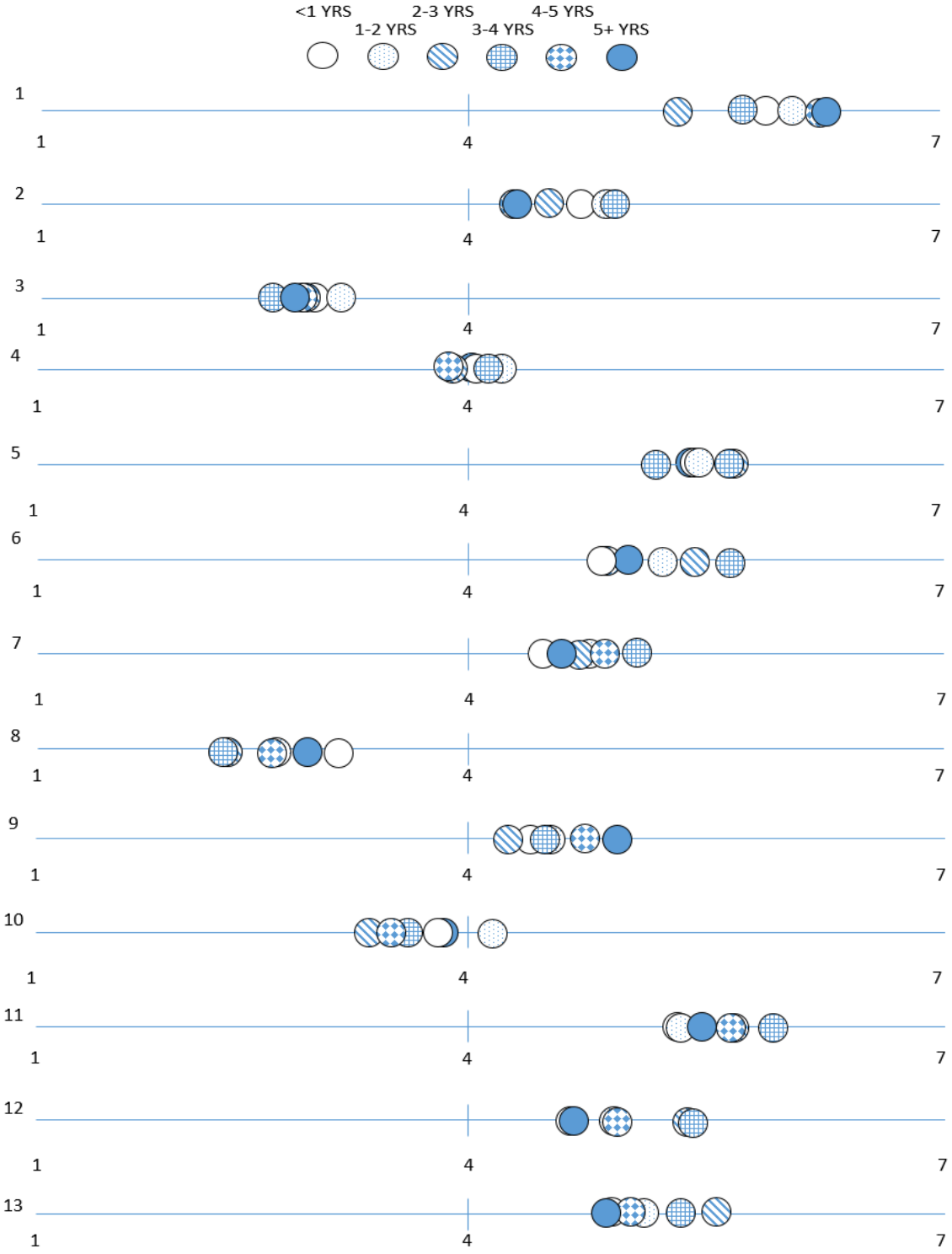
* denotes questions with significant differences ($p<0.05$)

Table 1.3 Biology 1110 Degree Status



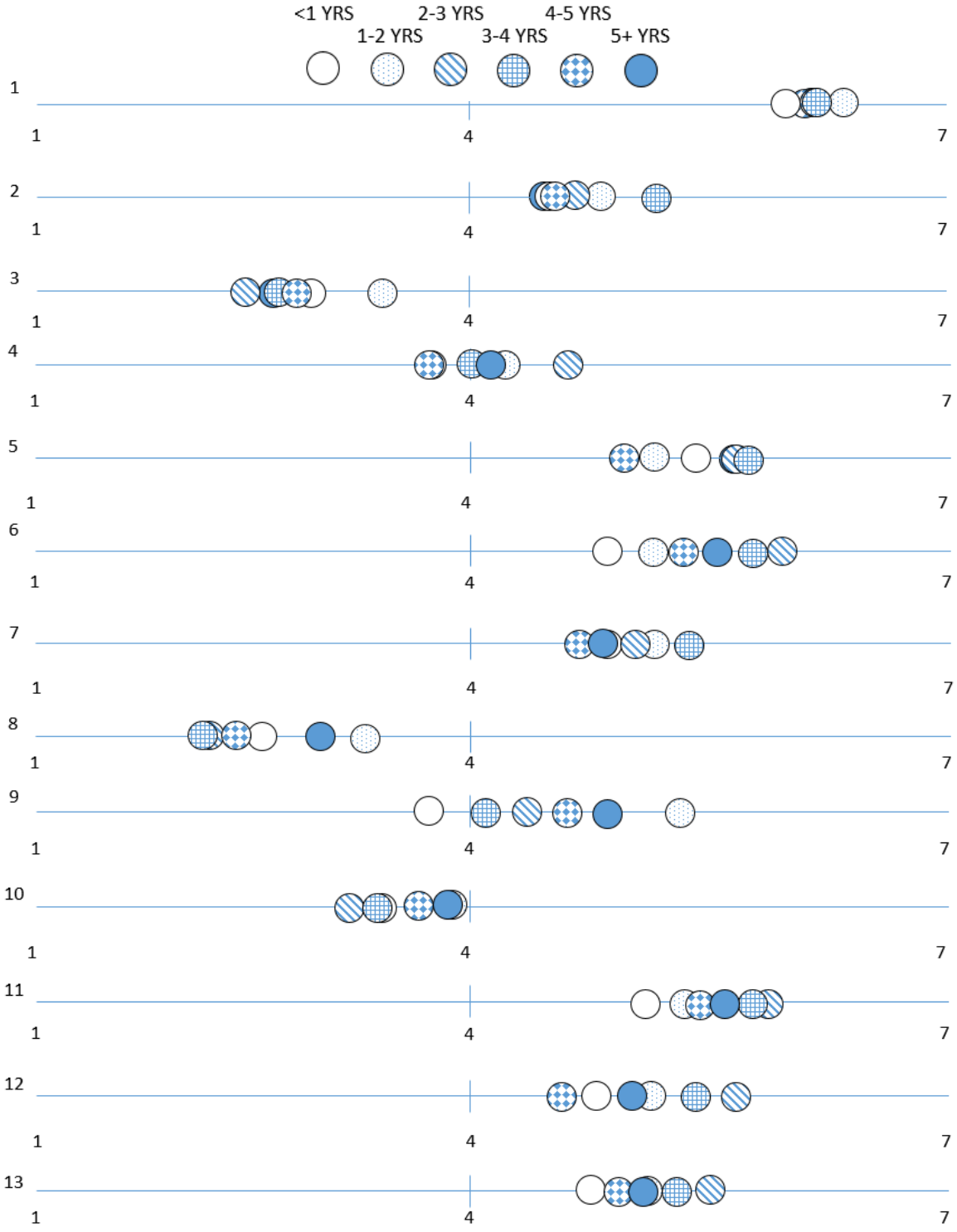
* denotes questions with significant differences ($p<0.05$)

Table 1.4 Biology 1110 Years of Personal Use of PowerPoint



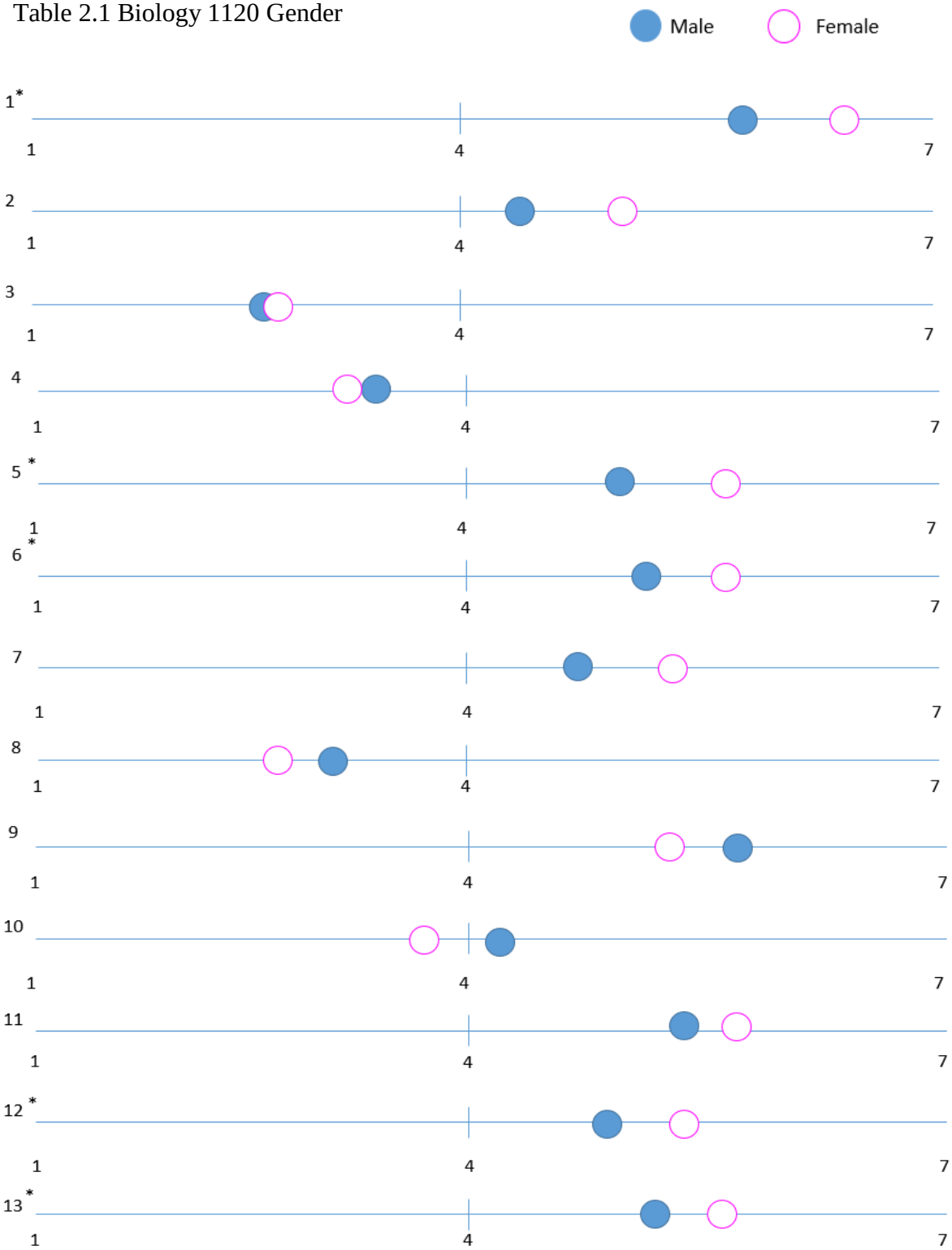
* denotes questions with significant differences ($p<0.05$)

Table 1.5 Biology 1110 Years of Classroom Use of PowerPoint



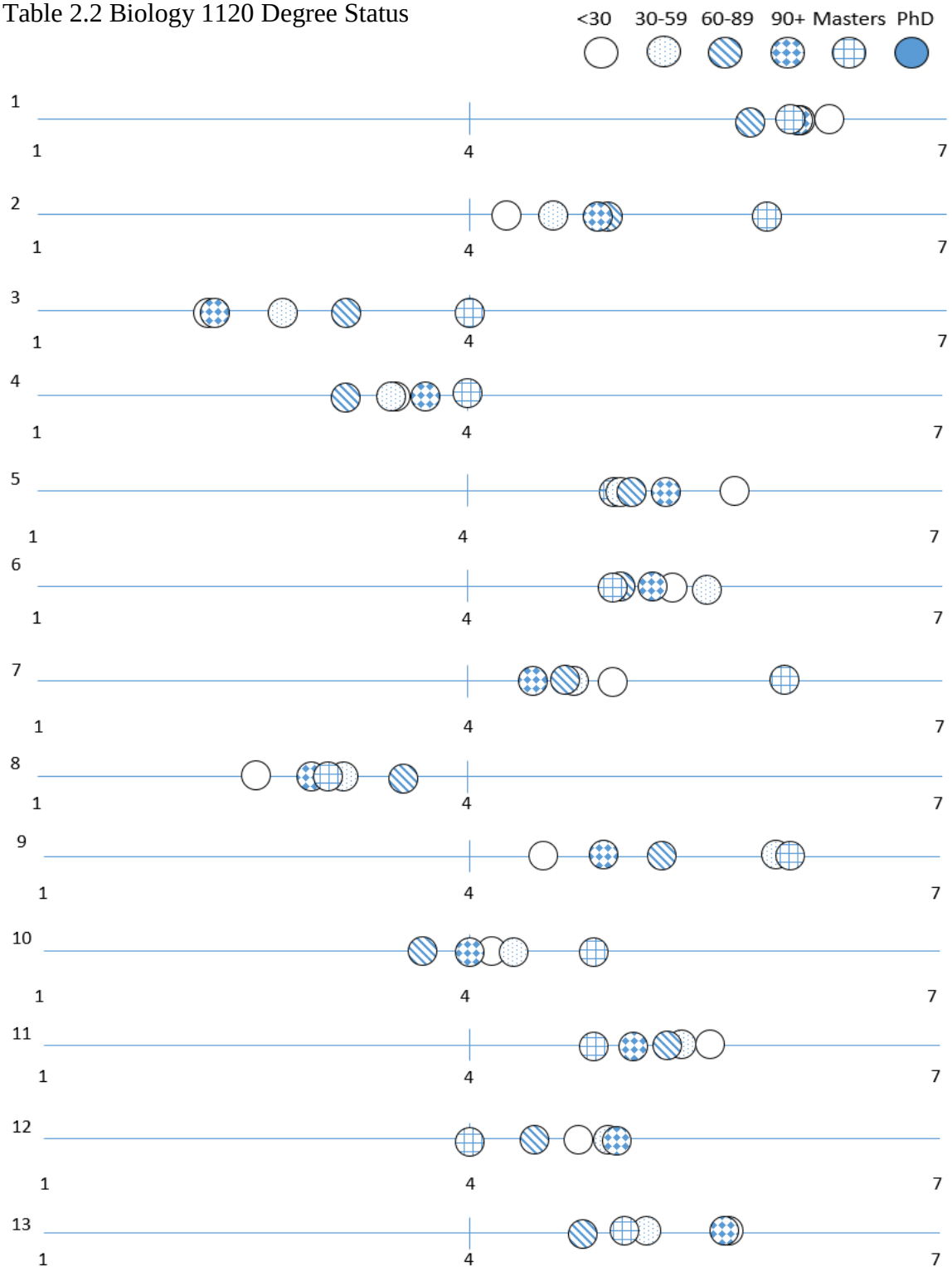
* denotes questions with significant differences ($p<0.05$)

Table 2.1 Biology 1120 Gender



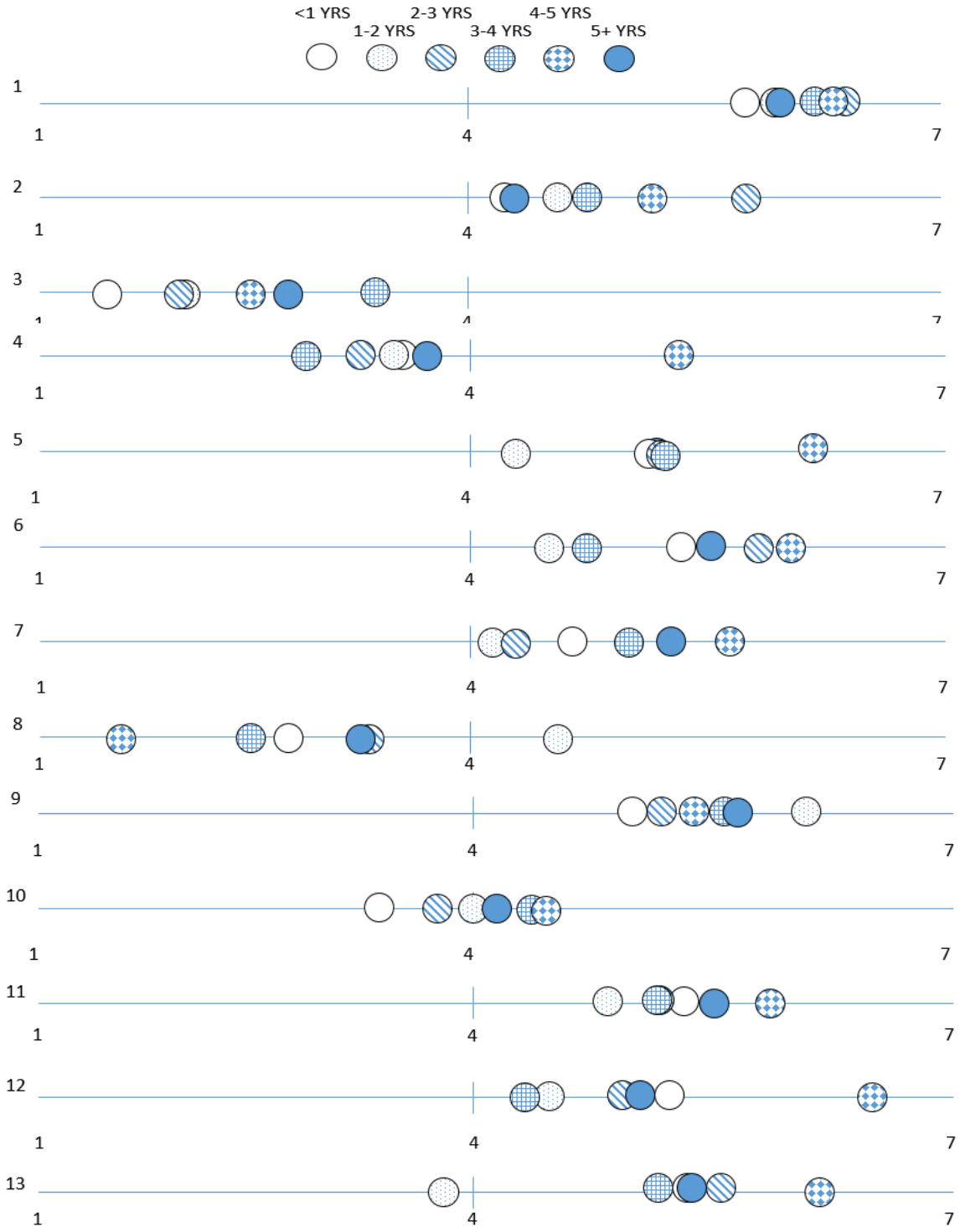
* denotes questions with significant differences ($p<0.05$)

Table 2.2 Biology 1120 Degree Status



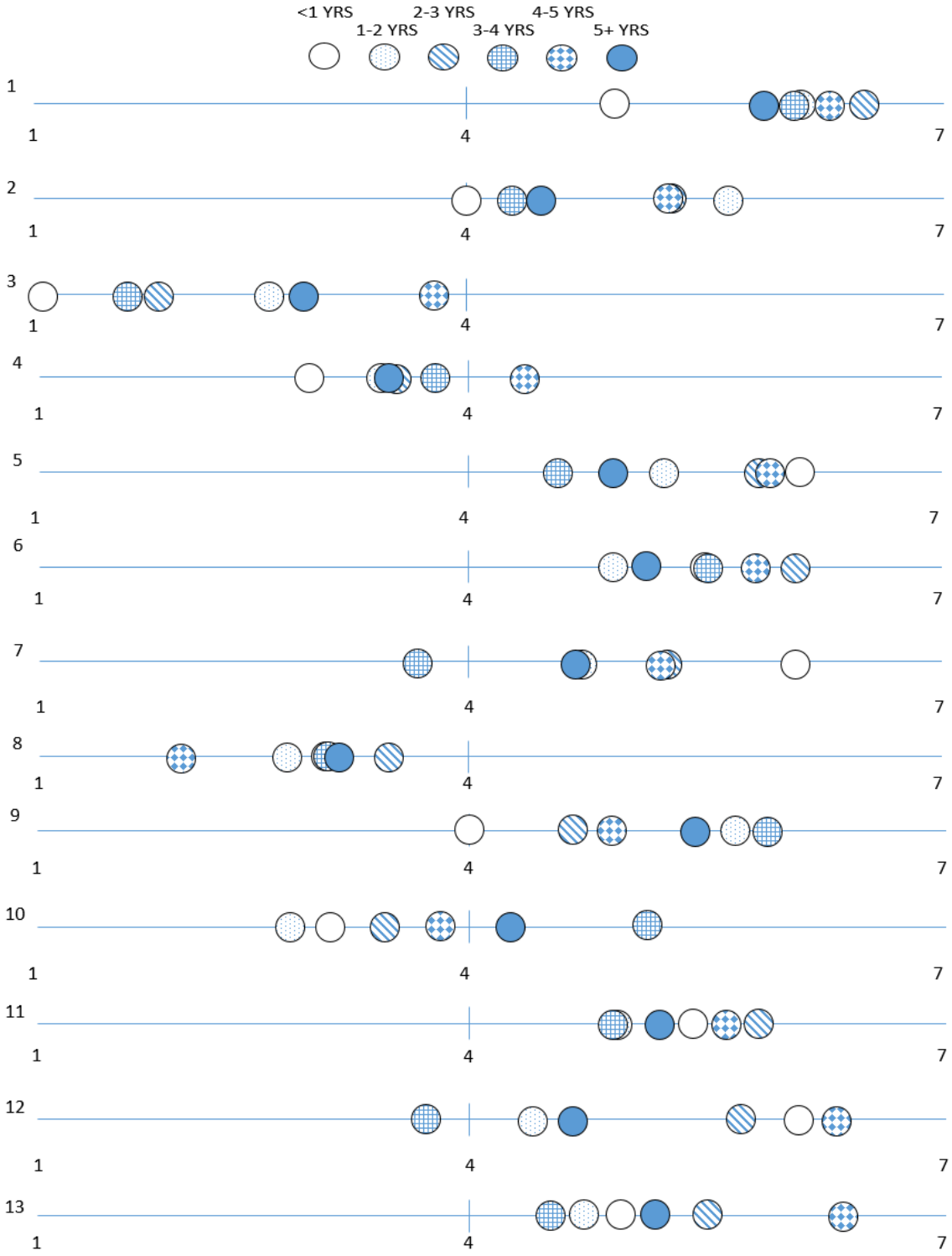
* denotes questions with significant differences ($p<0.05$)

Table 2.3 Biology 1120 Years of Personal Use of PowerPoint



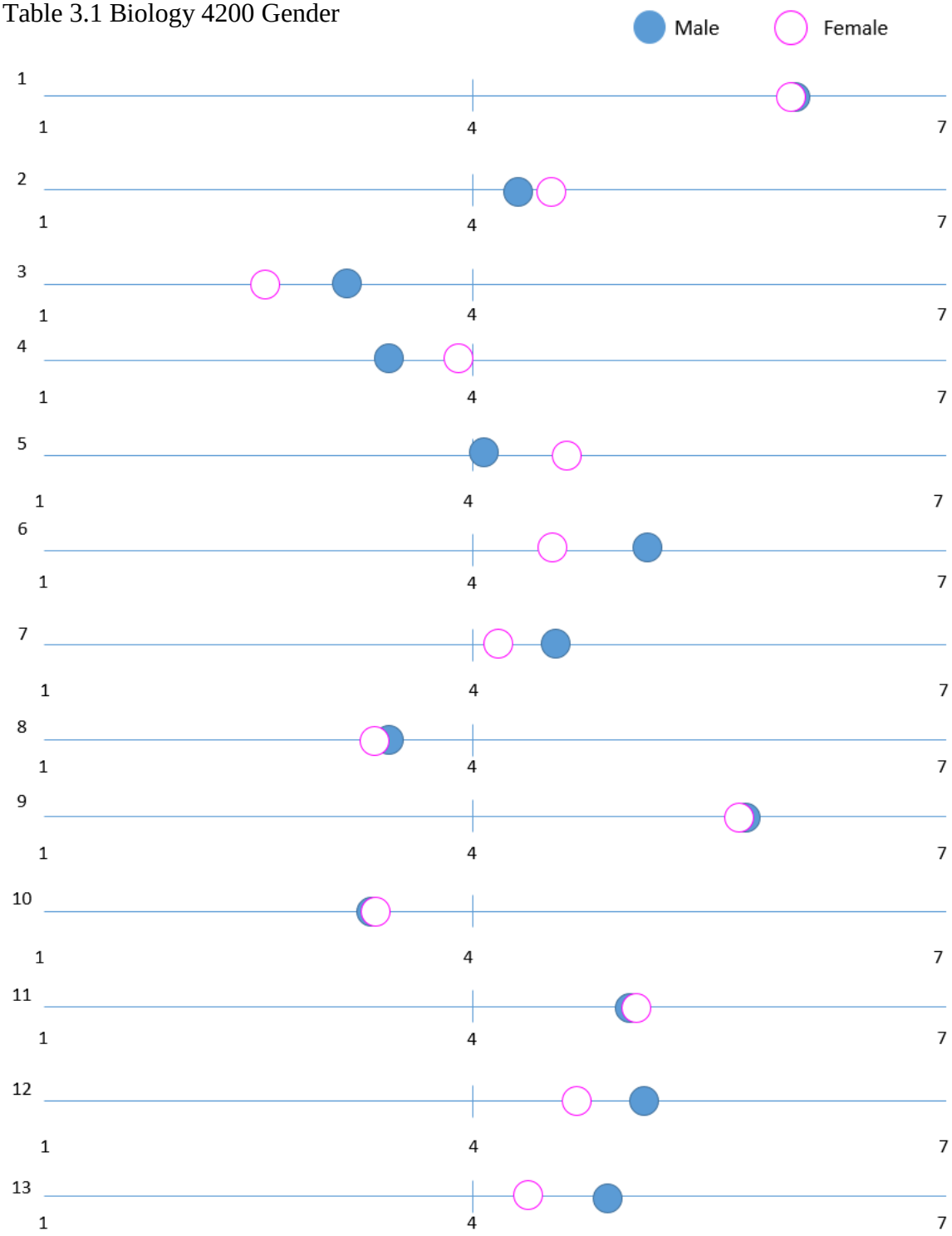
*denotes questions with significant differences ($p<0.05$)

Table 2.4 Biology 1120 Years of Classroom Use of PowerPoint



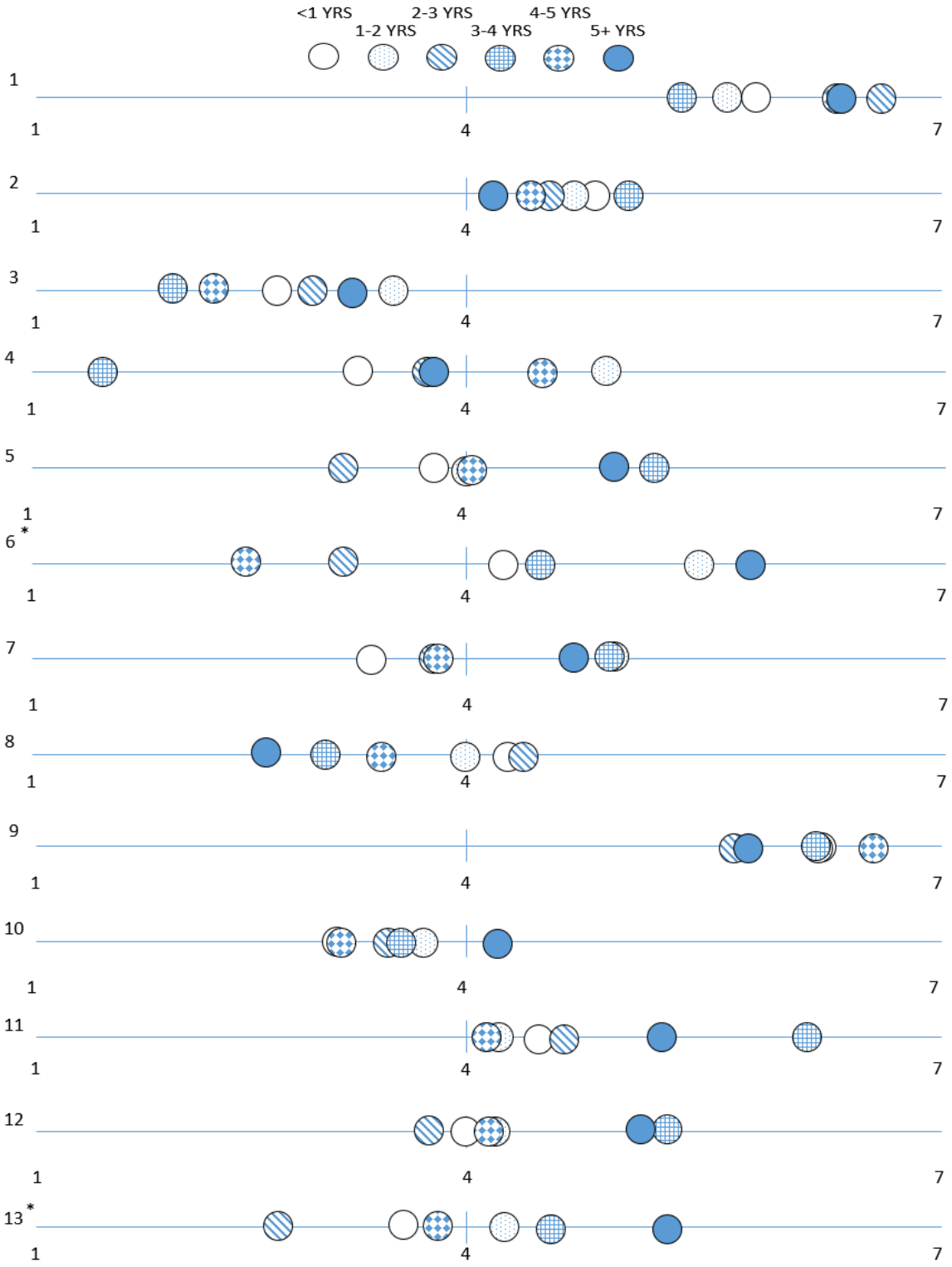
*denotes questions with significant differences ($p<0.05$)

Table 3.1 Biology 4200 Gender



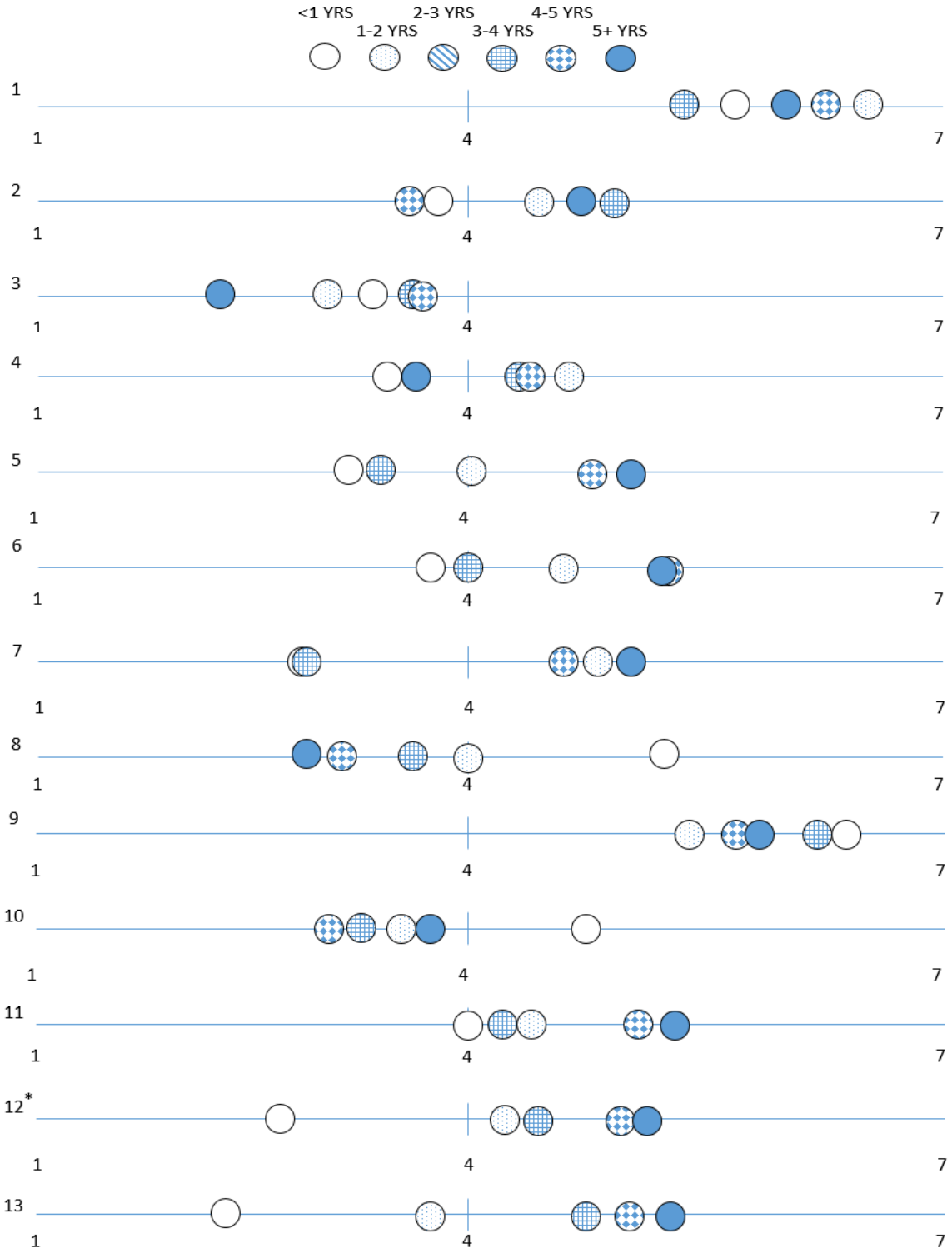
*denotes questions with significant differences ($p<0.05$)

Table 3.2 Biology 4200 Years of Personal Use of PowerPoint



* denotes questions with significant differences ($p<0.05$)

Table 3.3 Biology 4200 Years of Classroom Use of PowerPoint



* denotes questions with significant differences ($p<0.05$)

Table 4.1 18-25 Year Olds Gender

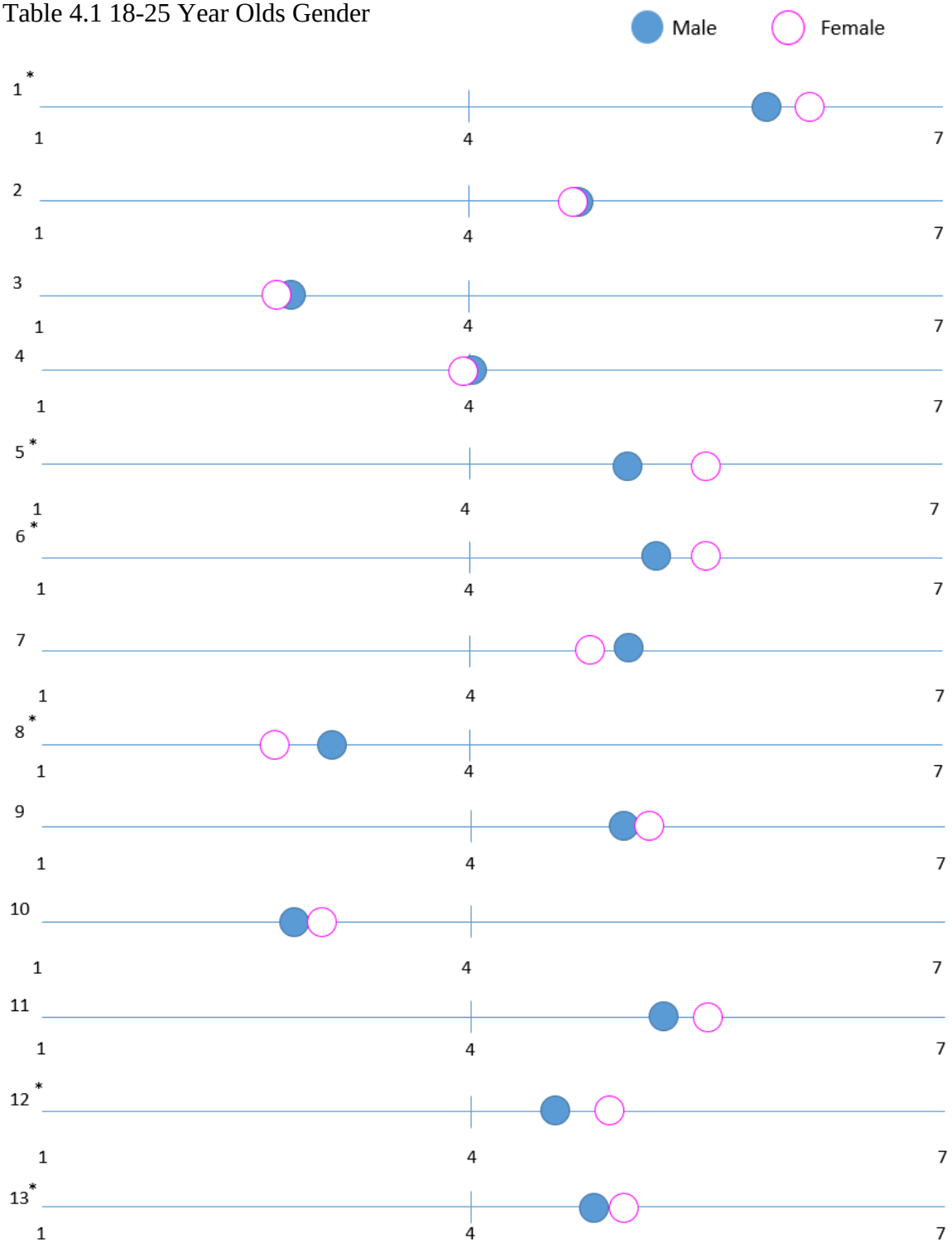


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Table 4.2 18-25 Year Olds Class

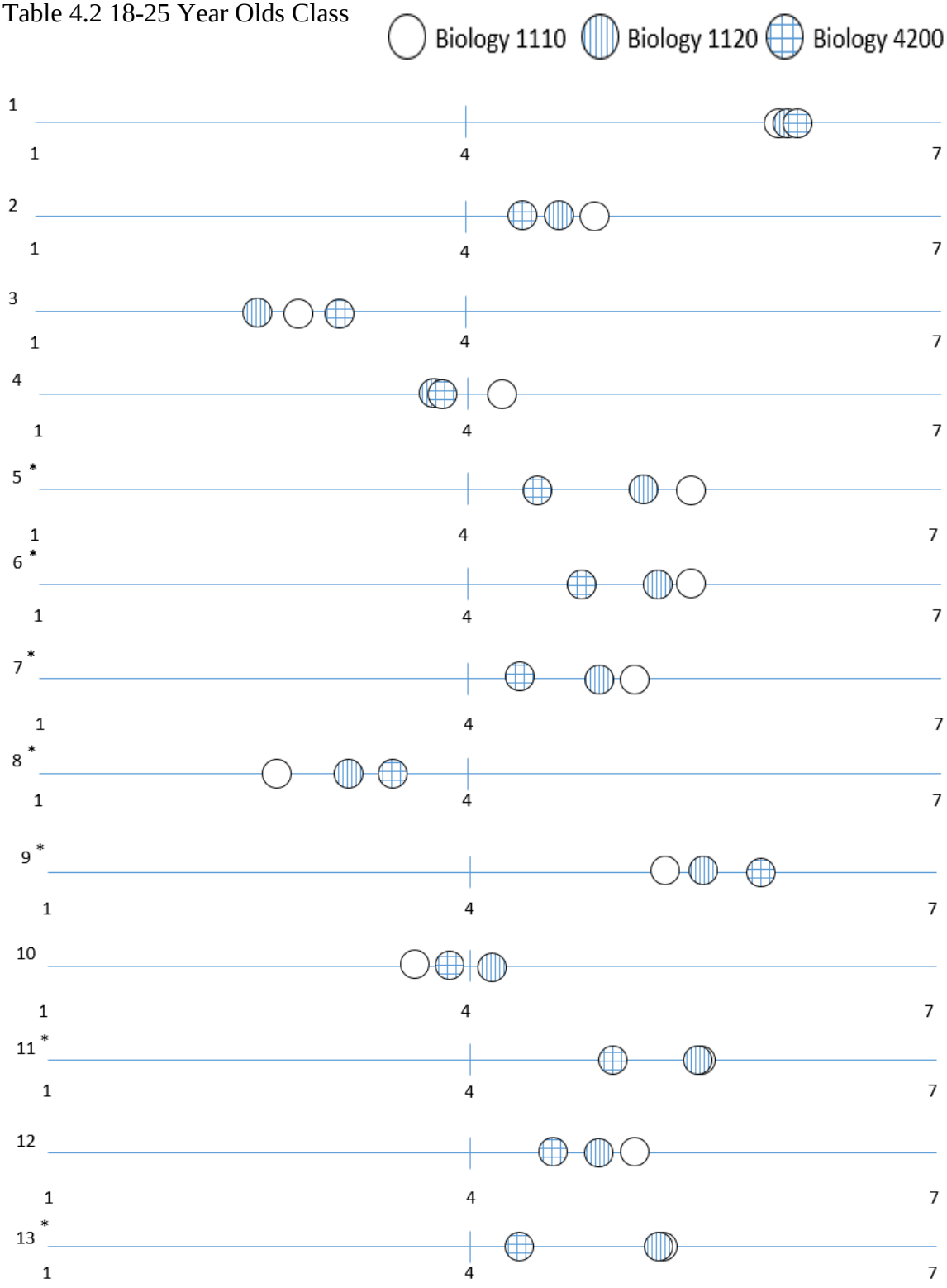

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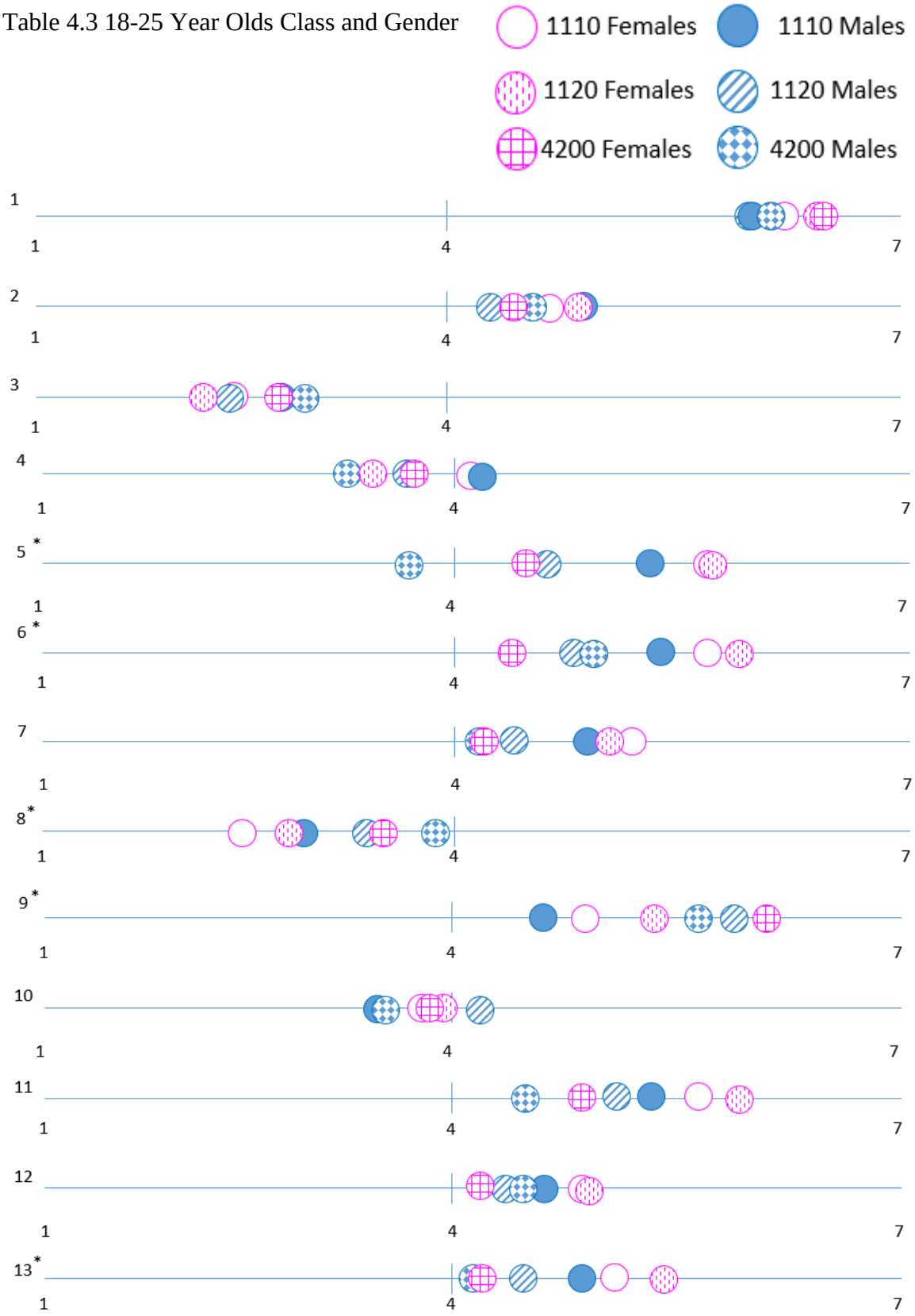
Table 4.3 18-25 Year Olds Class and Gender



* denotes questions with significant differences ($p<0.05$)

Appendices

Appendix A: Likert Survey

Appendix B: Standard Deviations

Appendix C: Data Summary

Appendix A

Please answer the questions in the following context:

This survey is examining perceptions of PowerPoint as an effective teaching tool for conveying course content in an introductory (MTSU Biol 1110/1120) Biology course for majors. Please answer these questions within that context.

This survey is completely voluntary and you are free to withdraw at any time. Results from this survey will be stored for 3 years in the office of Dr. Ryan Otter.

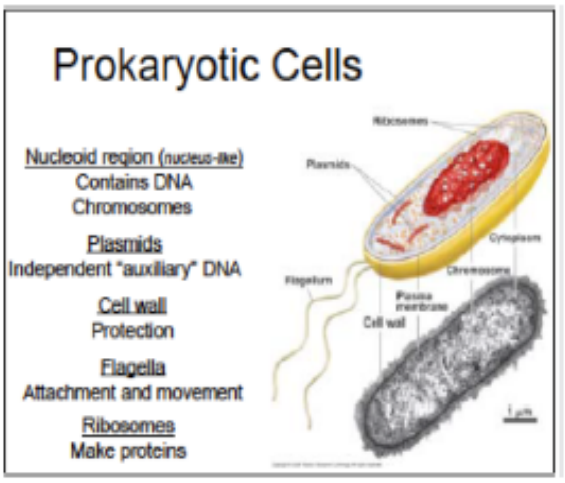
Contact information:

Emily Smith: ess3a@mtmail.mtsu.edu Dr. Ryan Otter: Ryan.Otter@mtsu.edu

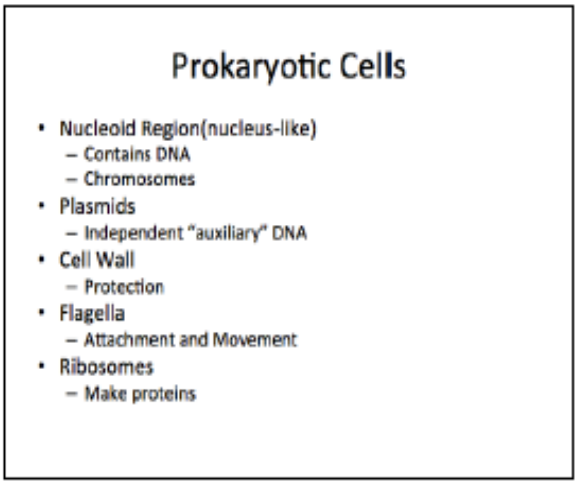
Strongly Disagree	Disagree	Disagree Somewhat	Neutral	Agree Somewhat	Agree	Strongly Agree
1	2	3	4	5	6	7

	1	2	3	4	5	6	7
1. I find visual elements such as pictures, diagrams, and graphs the most useful for student learning in PowerPoint presentations.	○	○	○	○	○	○	○
2. I prefer PowerPoint slides with full sentence concept outlines.	○	○	○	○	○	○	○
3. No text (just images/charts/graphs) on PowerPoint slides is most helpful for student learning of course content.	○	○	○	○	○	○	○
4. I prefer PowerPoint slides with only key terms and definitions written out.	○	○	○	○	○	○	○
5. PowerPoint use during lectures is the most effective form of communicating course content.	○	○	○	○	○	○	○
6. PowerPoint makes instructors look more prepared for their lecture.	○	○	○	○	○	○	○
7. PowerPoint effectively captures students' attention.	○	○	○	○	○	○	○
8. I think professors should spend less time using PowerPoint slides.	○	○	○	○	○	○	○
9. I personally find classroom instruction less engaging when PowerPoint slides are read verbatim by the speaker.	○	○	○	○	○	○	○
10. PowerPoint presentations are easy to assemble and do not require much preparation.	○	○	○	○	○	○	○
11. The utilization of PowerPoint is useful in increasing student learning in the classroom.	○	○	○	○	○	○	○
12. The use of PowerPoint in classroom instruction leads to better student grades on exams and final course grades.	○	○	○	○	○	○	○
13. PowerPoint use during lectures is, in my opinion, the most efficient form of communicating course content.	○	○	○	○	○	○	○

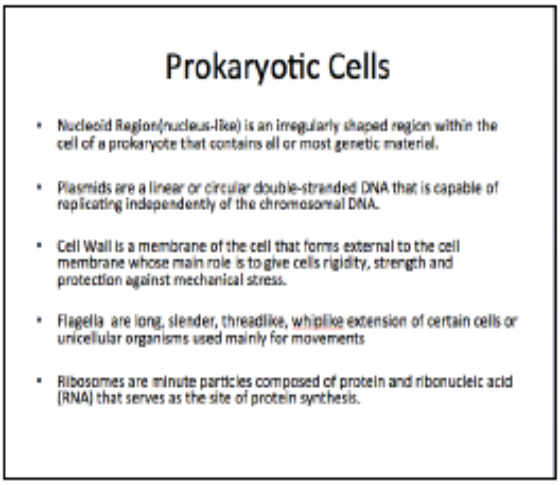
Please study the slides and answer the following questions:



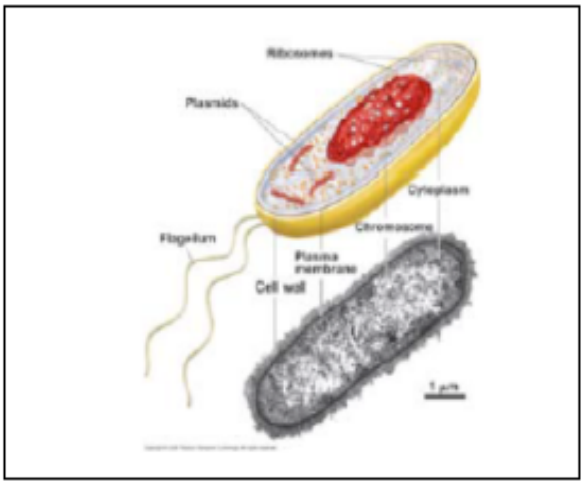
1



2



3



4

14. Which slide do you find most helpful in communicating information about prokaryotic cells in a lecture for an introductory Biology course for majors?

1 ○ 2 ○ 3 ○ 4 ○

15. Which slide do you find most visually pleasing?

1 ○ 2 ○ 3 ○ 4 ○

16. Which slide requires the least amount of time to prepare?

1 ○ 2 ○ 3 ○ 4 ○

17. Which slide do you perceive would be the most helpful for student learning about prokaryotic cells in a lecture for an introductory Biology course for majors?

1 ○ 2 ○ 3 ○ 4 ○

Demographic Information

18. Gender: Male ◯ Female ◯

19. Age: 18-25 ◯ 26-30 ◯ 31-35 ◯ 36-40 ◯ 41-45 ◯ 46-50 ◯ 51-55 ◯ >55 ◯

20. Degree Status: <30 credit hours ◯ 30-59 credit hours ◯ 60-89 credit hours ◯ 90+ credit hours ◯ Masters Student ◯ PhD Student ◯ Faculty ◯

21. If a faculty member, please mark your status: Adjunct ◯ Assistant ◯ Associate ◯ Full ◯

22. Years of personal PowerPoint use for presentation purposes:

<1 ◯ 1-2 ◯ 2-3 ◯ 3-4 ◯ 4-5 ◯ 5+ ◯

23. Years of PowerPoint use in classroom settings:

<1 ◯ 1-2 ◯ 2-3 ◯ 3-4 ◯ 4-5 ◯ 5+ ◯

Appendix B

1.1 Biology 1110 Only by Sex

	T-Test
Q1	**0.09**
Q2	**0.44**
Q3	**0.24**
Q4	**0.92**
Q5	**0.03**
Q6	**0.05**
Q7	**0.87**
Q8	**0.0098*****
Q9	**0.44**
Q10	**0.26**
Q11	**0.24**
Q12	**0.07**
Q13	**0.15**

1.2 Biology 1110 Only by Age

	ANOVA
Q1	**0.78**
Q2	**0.15**
Q3	**0.91**
Q4	**0.14**
Q5	**0.16**
Q6	**0.0014*****
Q7	**0.26**
Q8	**0.08**
Q9	**0.44**
Q10	**0.62**
Q11	**0.46**
Q12	**0.51**
Q13	**0.19**

1.3 Biology 1110 Only by Degree Status

	ANOVA
Q1	**0.08**
Q2	**0.26**
Q3	**0.06**
Q4	**0.0008******
Q5	**0.53**
Q6	**0.29**
Q7	**0.53**
Q8	**0.0497*****
Q9	**0.27**
Q10	**0.95**
Q11	**0.40**
Q12	**0.76**
Q13	**0.13**

1.4 Biology 1110 By Years of Personal Use of PowerPoint

	ANOVA
Q1	**0.12**
Q2	**0.59**
Q3	**0.95**
Q4	**0.97**
Q5	**0.68**
Q6	**0.06**
Q7	**0.45**
Q8	**0.50**
Q9	**0.75**
Q10	**0.65**
Q11	**0.19**
Q12	**0.09**
Q13	**0.60**

1.5 Biology 1110 By Years of Classroom Use of PowerPoint

	ANOVA
Q1	**0.966**
Q2	**0.2004**
Q3	**0.5166**
Q4	**0.41**
Q5	**0.656**
Q6	**0.1216**
Q7	**0.7971**
Q8	**0.1411**
Q9	**0.0017*****
Q10	**0.3528**
Q11	**0.0799**
Q12	**0.0714**
Q13	**0.5945**

2.1 Biology 1120 Classes by Sex

	T-Test
Q1	**0.0431******
Q2	**0.05**
Q3	**0.89**
Q4	**0.87**
Q5	**0.0094*******
Q6	**0.0283*******
Q7	**0.22**
Q8	**0.09**
Q9	**0.20**
Q10	**0.25**
Q11	**0.11**
Q12	**0.0409******
Q13	**0.0193*******

2.2 Biology 1120 by Degree Status

ANOVA

Q1	**0.95**
Q2	**0.55**
Q3	**0.49**
Q4	**0.86**
Q5	**0.65**
Q6	**0.94**
Q7	**0.83**
Q8	**0.49**
Q9	**0.06**
Q10	**0.71**
Q11	**0.96**
Q12	**0.85**
Q13	**0.62**

2.3 Biology 1120 By Years of Personal Use of PowerPoint

	ANOVA
Q1	**0.87**
Q2	**0.18**
Q3	**0.28**
Q4	**0.10**
Q5	**0.40**
Q6	**0.40**
Q7	**0.43**
Q8	**0.0178********
Q9	**0.82**
Q10	**0.66**
Q11	**0.92**
Q12	**0.13**
Q13	**0.18**

2.4 Biology 1120 By Years of Classroom Use of PowerPoint

ANOVA

Q1	**0.61**
Q2	**0.10**
Q3	**0.11**
Q4	**0.66**
Q5	**0.42**
Q6	**0.42**
Q7	**0.16**
Q8	**0.61**
Q9	**0.31**
Q10	**0.07**
Q11	**0.65**
Q12	**0.0012*****
Q13	**0.44**

3.1 Biology 4200 By Sex

	T-test
Q1	**0.95**
Q2	**0.55**
Q3	**0.15**
Q4	**0.27**
Q5	**0.30**
Q6	**0.11**
Q7	**0.51**
Q8	**0.91**
Q9	**0.92**
Q10	**0.93**
Q11	**0.87**
Q12	**0.19**
Q13	**0.59**

3.2 Biology 4200 By Years of Personal Use of PowerPoint

	ANOVA
Q1	**0.72**
Q2	**0.97**
Q3	**0.65**
Q4	**0.06**
Q5	**0.22**
Q6	**<0.0001********
Q7	**0.32**
Q8	**0.56**
Q9	**0.92**
Q10	**0.65**
Q11	**0.15**
Q12	**0.17**
Q13	**0.0124********

3.3 Biology 4200 By Years of Classroom Use of PowerPoint

	ANOVA
Q1	**0.36**
Q2	**0.47**
Q3	**0.24**
Q4	**0.41**
Q5	**0.24**
Q6	**0.43**
Q7	**0.16**
Q8	**0.05**
Q9	**0.78**
Q10	**0.79**
Q11	**0.24**
Q12	**0.0481*****
Q13	**0.06**

Appendix C

Data Summary

1.1 Biology 1110 By Sex

		F	M
N		266.00	190.00
Q1	**Mean**	**6.12**	**5.93**
	Std Err	0.07	0.09
Q2	**Mean**	**4.77**	**4.89**
	Std Err	0.10	0.12
Q3	**Mean**	**2.64**	**2.81**
	Std Err	0.09	0.11
Q4	**Mean**	**4.09**	**4.08**
	Std Err	0.10	0.12
Q5	**Mean**	**5.55**	**5.27**
	Std Err	0.08	0.10
Q6	**Mean**	**5.55**	**5.29**
	Std Err	0.08	0.11
Q7	**Mean**	**5.14**	**4.91**
	Std Err	0.09	0.11
Q8	**Mean**	**2.55**	**2.93**
	Std Err	0.09	0.11
Q9	**Mean**	**4.84**	**4.71**
	Std Err	0.11	0.14
Q10	**Mean**	**3.86**	**3.69**
	Std Err	0.10	0.11

Q11	**Mean**	**5.52**	**5.39**
	Std Err	0.07	0.09
Q12	**Mean**	**5.14**	**4.93**
	Std Err	0.08	0.09
Q13	**Mean**	**5.27**	**5.06**
	Std Err	0.09	0.10

1.2 Biology 1110 By Age

		>55	18-25	26-30	31-35	36-40	41-45
N							
Q1	**Mean**	**6.43**	**6.04**	**6.25**	**6.00**	**7.00**	**7.00**
	Std Err	0.20	0.06	0.25	0.37	.	0.00
Q2	**Mean**	**5.00**	**4.86**	**4.75**	**4.17**	**2.00**	**5.00**
	Std Err	0.76	0.08	0.52	0.60	.	0.00
Q3	**Mean**	**2.71**	**2.70**	**2.67**	**3.33**	**4.00**	**2.50**
	Std Err	0.64	0.07	0.33	0.56	.	0.50
Q4	**Mean**	**4.71**	**4.10**	**4.00**	**3.83**	**7.00**	**3.50**
	Std Err	0.61	0.08	0.41	0.79	.	0.50
Q5	**Mean**	**5.00**	**5.43**	**5.58**	**4.83**	**7.00**	**7.00**
	Std Err	0.31	0.07	0.26	0.70	.	0.00
Q6	**Mean**	**5.86**	**5.44**	**5.67**	**4.50**	**6.00**	**7.00**
	Std Err	0.51	0.07	0.43	0.81	.	0.00
Q7	**Mean**	**5.29**	**5.06**	**4.92**	**4.50**	**6.00**	**5.50**
	Std Err	0.61	0.07	0.43	0.56	.	0.50
Q8	**Mean**	**3.57**	**2.69**	**3.00**	**3.17**	**2.00**	**1.50**
	Std Err	0.57	0.07	0.39	0.91	.	0.50
Q9	**Mean**	**4.29**	**4.79**	**5.25**	**4.83**	**2.00**	**5.50**
	Std Err	0.84	0.09	0.28	0.83	.	1.50

Q10	**Mean**	**3.43**	**3.81**	**3.58**	**4.33**	**4.00**	**3.00**
	Std Err	0.48	0.08	0.45	0.56	.	0.00
Q11	**Mean**	**5.57**	**5.47**	**5.67**	**4.67**	**6.00**	**6.50**
	Std Err	0.37	0.06	0.31	0.42	.	0.50
Q12	**Mean**	**5.43**	**5.05**	**4.92**	**4.33**	**6.00**	**6.00**
	Std Err	0.37	0.06	0.34	0.61	.	1.00
Q13	**Mean**	**5.43**	**5.18**	**5.25**	**4.33**	**6.00**	**6.50**
	Std Err	0.37	0.07	0.37	0.84	.	0.50

1.3 Biology 1110 By Degree Status

		<30	30-59	60-89	90+	Masters	PhD
	N	247.00	109.00	49.00	46.00	1.00	1.00
Q1	**Mean**	**6.04**	**5.90**	**6.02**	**6.43**	**7.00**	**7.00**
	Std Err	0.08	0.11	0.16	0.10	0.00	.
Q2	**Mean**	**4.82**	**4.76**	**5.02**	**4.96**	**2.67**	**4.00**
	Std Err	0.10	0.17	0.24	0.23	0.67	.
Q3	**Mean**	**2.52**	**2.97**	**3.00**	**2.68**	**3.33**	**4.00**
	Std Err	0.09	0.14	0.22	0.22	0.67	.
Q4	**Mean**	**4.28**	**4.14**	**3.50**	**3.51**	**6.00**	**3.00**
	Std Err	0.10	0.14	0.24	0.25	1.00	.
Q5	**Mean**	**5.49**	**5.25**	**5.50**	**5.36**	**6.33**	**6.00**
	Std Err	0.08	0.12	0.24	0.22	0.67	.
Q6	**Mean**	**5.50**	**5.32**	**5.46**	**5.21**	**6.67**	**7.00**
	Std Err	0.08	0.12	0.23	0.28	0.33	.
Q7	**Mean**	**5.11**	**4.83**	**5.18**	**5.04**	**5.67**	**4.00**
	Std Err	0.09	0.13	0.22	0.25	0.88	.
Q8	**Mean**	**2.55**	**3.08**	**2.66**	**2.91**	**2.00**	**4.00**
	Std Err	0.10	0.15	0.24	0.24	0.00	.
Q9	**Mean**	**4.62**	**5.08**	**4.82**	**5.06**	**4.33**	**6.00**

	Std Err	0.12	0.16	0.28	0.26	1.45	.
Q10	**Mean**	**3.81**	**3.76**	**3.72**	**3.85**	**4.67**	**4.00**
	Std Err	0.10	0.15	0.21	0.28	0.67	.
Q11	**Mean**	**5.50**	**5.20**	**5.65**	**5.63**	**6.33**	**4.00**
	Std Err	0.07	0.11	0.16	0.18	0.33	.
Q12	**Mean**	**5.05**	**4.94**	**5.18**	**5.17**	**4.67**	**4.00**
	Std Err	0.08	0.12	0.19	0.20	0.67	.
Q13	**Mean**	**5.30**	**4.84**	**5.20**	**5.13**	**6.00**	**6.00**
	Std Err	0.09	0.14	0.24	0.26	0.58	.

1.4 Biology 1110 By Years of Personal Use of PowerPoint

		<1 YRS	**1-2 YRS**	**2-3 YRS**	**3-4 YRS**	**4-5 YRS**	**5+ YRS**
	N	**48.00**	**49.00**	**39.00**	**52.00**	**50.00**	**140.00**
Q1	**Mean**	**6.04**	**6.12**	**5.56**	**6.08**	**6.22**	**6.13**
	Std Err	**0.17**	**0.16**	**0.22**	**0.16**	**0.13**	**0.10**
Q2	**Mean**	**4.96**	**5.02**	**4.87**	**5.08**	**4.64**	**4.69**
	Std Err	**0.19**	**0.22**	**0.28**	**0.23**	**0.22**	**0.15**
Q3	**Mean**	**2.77**	**2.86**	**2.72**	**2.58**	**2.70**	**2.66**
	Std Err	**0.23**	**0.21**	**0.19**	**0.19**	**0.22**	**0.12**
Q4	**Mean**	**4.04**	**4.22**	**3.97**	**4.06**	**3.96**	**4.01**
	Std Err	**0.23**	**0.24**	**0.25**	**0.22**	**0.22**	**0.14**
Q5	**Mean**	**5.46**	**5.47**	**5.69**	**5.63**	**5.26**	**5.42**
	Std Err	**0.20**	**0.20**	**0.19**	**0.16**	**0.18**	**0.13**
Q6	**Mean**	**5.19**	**5.61**	**5.79**	**5.87**	**5.20**	**5.41**
	Std Err	**0.22**	**0.20**	**0.17**	**0.15**	**0.19**	**0.13**
Q7	**Mean**	**4.81**	**5.12**	**5.08**	**5.38**	**5.18**	**4.98**
	Std Err	**0.22**	**0.22**	**0.22**	**0.17**	**0.19**	**0.14**
Q8	**Mean**	**2.92**	**2.69**	**2.44**	**2.42**	**2.68**	**2.80**

	Std Err	**0.24**	**0.25**	**0.20**	**0.17**	**0.19**	**0.14**
Q9	**Mean**	**4.65**	**4.76**	**4.51**	**4.75**	**4.86**	**4.98**
	Std Err	**0.28**	**0.30**	**0.29**	**0.26**	**0.24**	**0.15**
Q10	**Mean**	**3.85**	**4.08**	**3.54**	**3.75**	**3.68**	**3.90**
	Std Err	**0.23**	**0.23**	**0.25**	**0.22**	**0.21**	**0.14**
Q11	**Mean**	**5.33**	**5.35**	**5.62**	**5.83**	**5.60**	**5.44**
	Std Err	**0.18**	**0.18**	**0.14**	**0.13**	**0.14**	**0.10**
Q12	**Mean**	**4.92**	**5.12**	**5.41**	**5.44**	**5.12**	**4.94**
	Std Err	**0.17**	**0.17**	**0.18**	**0.15**	**0.17**	**0.12**
Q13	**Mean**	**5.13**	**5.22**	**5.56**	**5.37**	**5.20**	**5.11**
	Std Err	**0.21**	**0.21**	**0.21**	**0.19**	**0.20**	**0.13**

1.5 Biology 1110 By Years of Classroom Use of PowerPoint

		<1 YRS	1-2 YRS	2-3 YRS	3-4 YRS	4-5 YRS	5+ YRS
	N	29.00	28.00	30.00	37.00	43.00	206.00
Q1	**Mean**	**5.90**	**6.18**	**6.10**	**6.11**	**6.05**	**6.07**
	Std Err	0.25	0.25	0.18	0.18	0.18	0.08
Q2	**Mean**	**4.72**	**5.07**	**5.00**	**5.43**	**4.86**	**4.70**
	Std Err	0.29	0.28	0.35	0.26	0.23	0.12
Q3	**Mean**	**2.86**	**3.14**	**2.50**	**2.68**	**2.77**	**2.62**
	Std Err	0.27	0.31	0.25	0.23	0.22	0.10
Q4	**Mean**	**3.72**	**4.18**	**4.43**	**4.00**	**3.72**	**4.10**
	Std Err	0.29	0.34	0.27	0.31	0.25	0.11
Q5	**Mean**	**5.38**	**5.25**	**5.53**	**5.59**	**5.16**	**5.50**
	Std Err	0.26	0.30	0.23	0.21	0.24	0.10
Q6	**Mean**	**5.03**	**5.25**	**5.90**	**5.81**	**5.37**	**5.46**
	Std Err	0.29	0.30	0.18	0.19	0.23	0.10

Q7	**Mean**	**5.03**	**5.18**	**5.10**	**5.38**	**4.93**	**5.02**
	Std Err	0.29	0.29	0.22	0.22	0.23	0.11
Q8	**Mean**	**2.55**	**3.11**	**2.33**	**2.30**	**2.47**	**2.80**
	Std Err	0.25	0.41	0.20	0.23	0.17	0.11
Q9	**Mean**	**3.90**	**5.39**	**4.63**	**4.08**	**4.88**	**5.02**
	Std Err	0.39	0.33	0.36	0.30	0.28	0.12
Q10	**Mean**	**3.52**	**3.96**	**3.40**	**3.54**	**3.81**	**3.94**
	Std Err	0.27	0.31	0.27	0.29	0.24	0.11
Q11	**Mean**	**5.14**	**5.29**	**5.83**	**5.78**	**5.35**	**5.51**
	Std Err	0.25	0.27	0.15	0.15	0.16	0.08
Q12	**Mean**	**4.93**	**5.14**	**5.57**	**5.35**	**4.72**	**5.08**
	Std Err	0.24	0.26	0.21	0.17	0.19	0.09
Q13	**Mean**	**4.90**	**5.25**	**5.53**	**5.38**	**5.07**	**5.23**
	Std Err	0.28	0.29	0.24	0.20	0.24	0.10

2.1 Biology 1120 By Sex

		F	**M**
	N	**50.00**	**43.00**
Q1	**Mean**	**6.26**	**5.77**
	Std Err	**0.14**	**0.20**
Q2	**Mean**	**4.96**	**4.35**
	Std Err	**0.19**	**0.24**
Q3	**Mean**	**2.60**	**2.56**
	Std Err	**0.22**	**0.19**
Q4	**Mean**	**3.55**	**3.60**
	Std Err	**0.21**	**0.27**
Q5	**Mean**	**5.60**	**4.84**
	Std Err	**0.18**	**0.23**

Q6	**Mean**	**5.58**	**4.91**
	Std Err	**0.18**	**0.25**
Q7	**Mean**	**5.04**	**4.51**
	Std Err	**0.19**	**0.24**
Q8	**Mean**	**2.84**	**3.24**
	Std Err	**0.22**	**0.23**
Q9	**Mean**	**5.20**	**5.63**
	Std Err	**0.22**	**0.25**
Q10	**Mean**	**3.84**	**4.23**
	Std Err	**0.21**	**0.27**
Q11	**Mean**	**5.60**	**5.21**
	Std Err	**0.17**	**0.17**
Q12	**Mean**	**5.20**	**4.63**
	Std Err	**0.18**	**0.21**
Q13	**Mean**	**5.52**	**4.77**
	Std Err	**0.21**	**0.23**

2.2 Biology 1120 By Age

2.3 Biology 1120 By Degree Status

		<30	30-59	60-89	90+	Masters
	N	20.00	34.00	20.00	18.00	1.00
Q1	**Mean**	**6.15**	**6.06**	**5.85**	**6.06**	**6.00**
	Std Err	0.36	0.19	0.26	0.19	.
Q2	**Mean**	**4.30**	**4.74**	**5.00**	**4.56**	**6.00**
	Std Err	0.38	0.27	0.29	0.32	.
Q3	**Mean**	**2.30**	**2.65**	**2.90**	**2.33**	**4.00**
	Std Err	0.27	0.24	0.38	0.31	.
Q4	**Mean**	**3.65**	**3.65**	**3.21**	**3.72**	**4.00**
	Std Err	0.46	0.28	0.28	0.35	.
Q5	**Mean**	**5.65**	**5.06**	**5.10**	**5.33**	**5.00**

	Std Err	0.28	0.26	0.35	0.31	.
Q6	**Mean**	**5.30**	**5.41**	**5.05**	**5.22**	**5.00**
	Std Err	0.36	0.24	0.40	0.30	.
Q7	**Mean**	**5.00**	**4.79**	**4.75**	**4.56**	**6.00**
	Std Err	0.41	0.26	0.35	0.25	.
Q8	**Mean**	**2.55**	**3.09**	**3.45**	**2.94**	**3.00**
	Std Err	0.30	0.28	0.39	0.35	.
Q9	**Mean**	**4.70**	**5.97**	**5.35**	**5.11**	**6.00**
	Std Err	0.46	0.18	0.33	0.45	.
Q10	**Mean**	**4.10**	**4.21**	**3.60**	**4.00**	**5.00**
	Std Err	0.43	0.26	0.28	0.45	.
Q11	**Mean**	**5.55**	**5.44**	**5.40**	**5.28**	**5.00**
	Std Err	0.29	0.21	0.27	0.23	.
Q12	**Mean**	**4.95**	**5.03**	**4.70**	**5.06**	**4.00**
	Std Err	0.33	0.23	0.36	0.24	.
Q13	**Mean**	**5.45**	**5.12**	**4.75**	**5.44**	**5.00**
	Std Err	0.33	0.30	0.38	0.27	.

2.4 Biology 1120 By Years of Personal Use of PowerPoint

		<1 YRS	**1-2 YRS**	**2-3 YRS**	**3-4 YRS**	**4-5 YRS**	**5+ YRS**
	N	**9.00**	**7.00**	**11.00**	**11.00**	**6.00**	**37.00**
Q1	**Mean**	**5.89**	**6.00**	**6.36**	**6.27**	**6.33**	**6.00**
	Std Err	**0.39**	**0.58**	**0.31**	**0.19**	**0.33**	**0.19**
Q2	**Mean**	**4.33**	**5.86**	**4.82**	**4.73**	**5.33**	**4.38**
	Std Err	**0.60**	**0.55**	**0.50**	**0.43**	**0.67**	**0.22**
Q3	**Mean**	**1.89**	**2.29**	**2.27**	**3.27**	**2.67**	**2.78**
	Std Err	**0.39**	**0.61**	**0.38**	**0.49**	**0.67**	**0.22**
Q4	**Mean**	**3.56**	**3.50**	**3.36**	**2.91**	**5.33**	**3.62**
	Std Err	**0.58**	**0.67**	**0.43**	**0.44**	**0.67**	**0.26**

Q5	**Mean**	**5.22**	**4.29**	**5.27**	**5.27**	**6.17**	**5.27**
	Std Err	**0.55**	**0.68**	**0.51**	**0.33**	**0.40**	**0.24**
Q6	**Mean**	**5.33**	**4.57**	**5.73**	**4.73**	**5.83**	**5.41**
	Std Err	**0.50**	**0.78**	**0.36**	**0.47**	**0.75**	**0.22**
Q7	**Mean**	**4.78**	**4.14**	**4.27**	**5.09**	**5.50**	**5.00**
	Std Err	**0.55**	**0.70**	**0.60**	**0.31**	**0.50**	**0.23**
Q8	**Mean**	**2.67**	**4.71**	**3.09**	**2.55**	**1.80**	**3.03**
	Std Err	**0.60**	**0.71**	**0.46**	**0.37**	**0.37**	**0.23**
Q9	**Mean**	**5.00**	**6.00**	**5.09**	**5.45**	**5.33**	**5.51**
	Std Err	**0.69**	**0.44**	**0.48**	**0.43**	**0.42**	**0.26**
Q10	**Mean**	**3.33**	**4.00**	**3.73**	**4.45**	**4.50**	**4.11**
	Std Err	**0.50**	**0.58**	**0.62**	**0.37**	**0.85**	**0.27**
Q11	**Mean**	**5.44**	**5.14**	**5.36**	**5.36**	**5.83**	**5.54**
	Std Err	**0.44**	**0.51**	**0.39**	**0.31**	**0.31**	**0.19**
Q12	**Mean**	**5.11**	**4.57**	**4.91**	**4.45**	**6.33**	**4.95**
	Std Err	**0.59**	**0.61**	**0.48**	**0.31**	**0.33**	**0.19**
Q13	**Mean**	**5.22**	**3.86**	**5.36**	**5.00**	**6.00**	**5.38**
	Std Err	**0.72**	**0.80**	**0.43**	**0.33**	**0.52**	**0.23**

2.5 Biology 1120 By Years of Classroom Use of PowerPoint

		<1 YRS	**1-2 YRS**	**2-3 YRS**	**3-4 YRS**	**4-5 YRS**	**5+ YRS**
	N	**2.00**	**7.00**	**11.00**	**8.00**	**8.00**	**45.00**
Q1	**Mean**	**5.00**	**6.14**	**6.45**	**6.13**	**6.25**	**6.02**
	Std Err	**2.00**	**0.46**	**0.31**	**0.35**	**0.31**	**0.16**
Q2	**Mean**	**4.00**	**5.71**	**5.27**	**4.25**	**5.25**	**4.38**
	Std Err	**3.00**	**0.42**	**0.60**	**0.37**	**0.45**	**0.19**
Q3	**Mean**	**1.00**	**2.57**	**2.00**	**1.88**	**3.75**	**2.80**
	Std Err	**0.00**	**0.57**	**0.43**	**0.35**	**0.65**	**0.19**
Q4	**Mean**	**3.00**	**3.43**	**3.50**	**3.88**	**4.50**	**3.47**

	Std Err	**2.00**	**0.57**	**0.43**	**0.64**	**0.76**	**0.23**
Q5	**Mean**	**6.00**	**5.29**	**5.73**	**4.63**	**5.88**	**5.09**
	Std Err	**1.00**	**0.42**	**0.49**	**0.71**	**0.40**	**0.22**
Q6	**Mean**	**5.50**	**5.00**	**6.09**	**5.00**	**5.75**	**5.13**
	Std Err	**1.50**	**0.79**	**0.37**	**0.60**	**0.65**	**0.20**
Q7	**Mean**	**6.00**	**4.86**	**5.27**	**3.63**	**5.25**	**4.84**
	Std Err	**1.00**	**0.51**	**0.57**	**0.60**	**0.45**	**0.21**
Q8	**Mean**	**3.00**	**2.86**	**3.45**	**3.00**	**2.13**	**3.07**
	Std Err	**2.00**	**0.67**	**0.58**	**0.60**	**0.40**	**0.21**
Q9	**Mean**	**4.00**	**5.71**	**4.73**	**5.88**	**5.00**	**5.60**
	Std Err	**3.00**	**0.52**	**0.47**	**0.40**	**0.42**	**0.23**
Q10	**Mean**	**3.00**	**2.86**	**3.36**	**5.13**	**3.88**	**4.27**
	Std Err	**2.00**	**0.51**	**0.39**	**0.58**	**0.64**	**0.23**
Q11	**Mean**	**5.50**	**5.14**	**5.91**	**5.13**	**5.75**	**5.42**
	Std Err	**1.50**	**0.46**	**0.41**	**0.30**	**0.37**	**0.17**
Q12	**Mean**	**6.00**	**4.57**	**5.73**	**3.75**	**6.13**	**4.80**
	Std Err	**1.00**	**0.53**	**0.49**	**0.37**	**0.40**	**0.17**
Q13	**Mean**	**5.00**	**4.86**	**5.55**	**4.63**	**6.13**	**5.16**
	Std Err	**2.00**	**0.77**	**0.49**	**0.63**	**0.40**	**0.22**

3.1 Biology 4200 By Sex

		F	M
	N	36.00	16.00
Q1	**Mean**	**6.17**	**6.19**
	Std Err	0.19	0.26
Q2	**Mean**	**4.58**	**4.25**
	Std Err	0.32	0.39
Q3	**Mean**	**2.67**	**3.25**
	Std Err	0.21	0.37
Q4	**Mean**	**3.97**	**3.44**

	Std Err	0.25	0.46
Q5	**Mean**	**4.61**	**4.06**
	Std Err	0.27	0.50
Q6	**Mean**	**4.47**	**5.25**
	Std Err	0.27	0.38
Q7	**Mean**	**4.22**	**4.56**
	Std Err	0.30	0.38
Q8	**Mean**	**3.44**	**3.50**
	Std Err	0.26	0.38
Q9	**Mean**	**5.83**	**5.88**
	Std Err	0.23	0.33
Q10	**Mean**	**3.67**	**3.63**
	Std Err	0.27	0.30
Q11	**Mean**	**5.00**	**4.94**
	Std Err	0.20	0.37
Q12	**Mean**	**4.50**	**5.07**
	Std Err	0.23	0.36
Q13	**Mean**	**4.33**	**4.63**
	Std Err	0.29	0.46

3.2 Biology 4200 By Age

		18-25	**26-30**	**31-35**	**36-40**
	N	**41.00**	**8.00**	**3.00**	**1.00**
Q1	**Mean**	**6.12**	**6.13**	**6.33**	**6.00**
	Std Err	**0.18**	**0.40**	**0.67**	**.**
Q2	**Mean**	**4.46**	**4.13**	**4.00**	**6.00**
	Std Err	**0.29**	**0.64**	**1.73**	**.**
Q3	**Mean**	**2.93**	**2.50**	**4.00**	**3.00**
	Std Err	**0.23**	**0.33**	**1.53**	**.**
Q4	**Mean**	**3.78**	**4.75**	**2.33**	**4.00**

	Std Err	**0.24**	**0.62**	**0.88**	**.**
Q5	**Mean**	**4.39**	**4.25**	**6.00**	**6.00**
	Std Err	**0.27**	**0.67**	**1.00**	**.**
Q6	**Mean**	**4.73**	**3.88**	**6.33**	**7.00**
	Std Err	**0.24**	**0.67**	**0.67**	**.**
Q7	**Mean**	**4.29**	**4.00**	**6.00**	**3.00**
	Std Err	**0.26**	**0.63**	**1.00**	**.**
Q8	**Mean**	**3.56**	**3.50**	**2.33**	**2.00**
	Std Err	**0.22**	**0.76**	**0.88**	**.**
Q9	**Mean**	**5.90**	**6.38**	**4.33**	**4.00**
	Std Err	**0.20**	**0.26**	**1.45**	**.**
Q10	**Mean**	**3.90**	**3.00**	**3.33**	**2.00**
	Std Err	**0.24**	**0.46**	**0.33**	**.**
Q11	**Mean**	**4.98**	**4.50**	**6.00**	**6.00**
	Std Err	**0.18**	**0.57**	**1.00**	**.**
Q12	**Mean**	**4.60**	**4.50**	**6.00**	**6.00**
	Std Err	**0.21**	**0.63**	**1.00**	**.**
Q13	**Mean**	**4.37**	**4.25**	**6.00**	**6.00**
	Std Err	**0.28**	**0.62**	**1.00**	**.**

3.3 Biology 4200 By Degree Status

		30-59	**60-89**	**90+**
	N	**1.00**	**7.00**	**45.00**
Q1	**Mean**	**6.00**	**6.57**	**6.07**
	Std Err	**.**	**0.20**	**0.18**
Q2	**Mean**	**3.00**	**4.57**	**4.42**
	Std Err	**.**	**0.72**	**0.28**
Q3	**Mean**	**5.00**	**3.71**	**2.76**
	Std Err	**.**	**0.57**	**0.21**
Q4	**Mean**	**5.00**	**3.86**	**3.82**

	Std Err	**.**	**0.40**	**0.25**
Q5	**Mean**	**3.00**	**4.57**	**4.51**
	Std Err	**.**	**0.61**	**0.27**
Q6	**Mean**	**3.00**	**5.14**	**4.71**
	Std Err	**.**	**0.51**	**0.25**
Q7	**Mean**	**3.00**	**4.00**	**4.40**
	Std Err	**.**	**0.62**	**0.26**
Q8	**Mean**	**5.00**	**3.14**	**3.47**
	Std Err	**.**	**0.55**	**0.23**
Q9	**Mean**	**7.00**	**5.71**	**5.84**
	Std Err	**.**	**0.52**	**0.20**
Q10	**Mean**	**5.00**	**4.29**	**3.58**
	Std Err	**.**	**0.57**	**0.22**
Q11	**Mean**	**4.00**	**5.00**	**5.00**
	Std Err	**.**	**0.38**	**0.20**
Q12	**Mean**	**4.00**	**4.71**	**4.70**
	Std Err	**.**	**0.68**	**0.21**
Q13	**Mean**	**1.00**	**4.86**	**4.49**
	Std Err	**.**	**0.67**	**0.26**

3.4 Biology 4200 By Years of Personal Use of PowerPoint

		<1 YRS	**1-2 YRS**	**2-3 YRS**	**3-4 YRS**	**4-5 YRS**	**5+ YRS**
	N	**6.00**	**4.00**	**5.00**	**3.00**	**6.00**	**23.00**
Q1	**Mean**	**5.83**	**5.75**	**6.60**	**5.33**	**6.17**	**6.17**
	Std Err	**0.65**	**0.75**	**0.24**	**1.20**	**0.40**	**0.21**
Q2	**Mean**	**4.83**	**4.75**	**4.60**	**5.00**	**4.50**	**4.22**
	Std Err	**0.40**	**0.85**	**0.75**	**0.58**	**0.89**	**0.45**
Q3	**Mean**	**2.83**	**3.50**	**3.00**	**2.00**	**2.33**	**3.22**
	Std Err	**0.48**	**0.50**	**0.89**	**0.58**	**0.61**	**0.34**
Q4	**Mean**	**3.33**	**5.00**	**3.80**	**1.67**	**4.67**	**3.83**

	Std Err	**0.67**	**0.71**	**0.49**	**0.33**	**0.76**	**0.31**
Q5	**Mean**	**3.83**	**4.00**	**3.20**	**5.33**	**4.00**	**5.04**
	Std Err	**0.60**	**1.08**	**1.02**	**0.33**	**0.89**	**0.33**
Q6	**Mean**	**4.33**	**5.50**	**3.20**	**4.67**	**2.83**	**5.70**
	Std Err	**0.61**	**0.65**	**0.49**	**0.67**	**0.31**	**0.24**
Q7	**Mean**	**3.33**	**5.00**	**3.80**	**5.00**	**3.83**	**4.83**
	Std Err	**0.67**	**0.71**	**1.02**	**0.58**	**0.70**	**0.34**
Q8	**Mean**	**4.50**	**4.00**	**4.40**	**3.00**	**3.33**	**2.83**
	Std Err	**0.56**	**0.41**	**0.98**	**0.00**	**0.67**	**0.25**
Q9	**Mean**	**6.00**	**6.00**	**5.60**	**6.00**	**6.33**	**5.65**
	Std Err	**0.26**	**0.71**	**0.98**	**0.58**	**0.42**	**0.31**
Q10	**Mean**	**3.33**	**3.75**	**3.60**	**3.67**	**3.33**	**4.22**
	Std Err	**0.56**	**0.85**	**0.81**	**0.67**	**0.42**	**0.29**
Q11	**Mean**	**4.50**	**4.25**	**4.60**	**6.00**	**4.17**	**5.30**
	Std Err	**0.43**	**0.63**	**0.51**	**0.58**	**0.65**	**0.26**
Q12	**Mean**	**4.00**	**4.25**	**3.80**	**5.33**	**4.17**	**5.23**
	Std Err	**0.73**	**0.63**	**0.73**	**0.33**	**0.75**	**0.26**
Q13	**Mean**	**3.67**	**4.25**	**2.60**	**4.67**	**3.83**	**5.35**
	Std Err	**0.80**	**0.63**	**0.98**	**0.88**	**0.87**	**0.25**

3.5 Biology 4200 By Years of Classroom Use of PowerPoint

		<1 YRS	1-2 YRS	3-4 YRS	4-5 YRS	5+ YRS
	N	5.00	5.00	3.00	10.00	23.00
Q1	**Mean**	**5.60**	**6.60**	**5.33**	**6.40**	**6.17**
	Std Err	0.68	0.40	0.33	0.22	0.24
Q2	**Mean**	**3.80**	**4.40**	**5.00**	**3.70**	**4.87**
	Std Err	0.49	0.75	1.53	0.62	0.40
Q3	**Mean**	**3.40**	**3.20**	**3.67**	**3.70**	**2.52**
	Std Err	0.81	0.66	0.33	0.52	0.29

Q4	**Mean**	**3.40**	**4.60**	**4.33**	**4.40**	**3.52**
	Std Err	0.68	0.60	0.33	0.64	0.31
Q5	**Mean**	**3.20**	**4.00**	**3.33**	**4.70**	**4.91**
	Std Err	0.73	1.00	0.88	0.60	0.35
Q6	**Mean**	**3.80**	**4.60**	**4.00**	**5.10**	**5.09**
	Std Err	0.58	0.93	0.58	0.60	0.29
Q7	**Mean**	**3.00**	**4.80**	**3.00**	**4.60**	**4.74**
	Std Err	0.95	0.86	1.15	0.62	0.28
Q8	**Mean**	**5.00**	**4.00**	**3.67**	**3.10**	**3.00**
	Std Err	0.63	0.71	0.67	0.38	0.29
Q9	**Mean**	**6.40**	**5.40**	**6.33**	**5.70**	**5.78**
	Std Err	0.24	1.03	0.67	0.45	0.28
Q10	**Mean**	**4.60**	**3.80**	**3.67**	**3.60**	**3.87**
	Std Err	0.68	0.80	0.33	0.34	0.32
Q11	**Mean**	**4.00**	**4.40**	**4.33**	**5.10**	**5.26**
	Std Err	0.55	0.51	0.33	0.38	0.30
Q12	**Mean**	**3.00**	**4.20**	**4.33**	**5.00**	**5.09**
	Std Err	0.95	0.49	0.33	0.58	0.23
Q13	**Mean**	**2.60**	**3.80**	**4.67**	**4.80**	**5.00**
	Std Err	0.93	0.86	0.88	0.63	0.29

4.1 18-25 Year Olds By Sex

		F	M
Q1	Mean	6.14	5.93
	Std Err	0.06	0.08
	N	324.00	226.00
Q2	Mean	4.79	4.81
	Std Err	0.09	0.11
	N	324.00	226.00
Q3	Mean	2.64	2.77
	Std Err	0.08	0.10
	N	323.00	226.00
Q4	Mean	3.99	4.03
	Std Err	0.09	0.11

	N	322.00	225.00
Q5	Mean	5.50	5.08
	Std Err	0.08	0.10
	N	324.00	226.00
Q6	Mean	5.48	5.23
	Std Err	0.07	0.10
	N	324.00	226.00
Q7	Mean	5.06	4.83
	Std Err	0.08	0.10
	N	324.00	226.00
Q8	Mean	2.65	3.04
	Std Err	0.08	0.10
	N	323.00	224.00
Q9	Mean	5.02	4.93
	Std Err	0.10	0.12
	N	324.00	226.00
Q10	Mean	3.90	3.81
	Std Err	0.09	0.10
	N	324.00	225.00
Q11	Mean	5.51	5.32
	Std Err	0.06	0.08
	N	322.00	225.00
Q12	Mean	5.10	4.86
	Std Err	0.07	0.09
	N	323.00	225.00
Q13	Mean	5.23	4.96
	Std Err	0.09	0.10
	N	324.00	226.00

4.2 18-25 Year Olds By Class

		1110	1120	4200
Q1	Mean	6.04	6.09	6.12
	Std Err	0.06	0.11	0.18
Q2	Mean	4.86	4.63	4.46
	Std Err	0.08	0.16	0.29
Q3	Mean	2.70	2.58	2.93
	Std Err	0.07	0.15	0.23
Q4	Mean	4.10	3.71	3.78
	Std Err	0.08	0.17	0.24
Q5	Mean	5.43	5.21	4.39
	Std Err	0.07	0.16	0.27
Q6	Mean	5.44	5.33	4.73
	Std Err	0.07	0.15	0.24

Q7	Mean	5.06	4.81	4.29
	Std Err	0.07	0.16	0.26
Q8	Mean	2.69	3.07	3.56
	Std Err	0.07	0.17	0.22
Q9	Mean	4.79	5.52	5.90
	Std Err	0.09	0.16	0.20
Q10	Mean	3.81	4.09	3.90
	Std Err	0.08	0.17	0.24
Q11	Mean	5.47	5.45	4.98
	Std Err	0.06	0.12	0.18
Q12	Mean	5.05	4.93	4.60
	Std Err	0.06	0.14	0.21
Q13	Mean	5.18	5.17	4.37
	Std Err	0.07	0.17	0.28

4.3 18-25 Year Olds By Class and Sex

		1110 F	1110 M	1120 F	1120 M	4200 F	4200 M
Q1	Mean	6.11	5.92	6.23	5.92	6.22	6.08
	Std Err	0.07	0.10	0.15	0.17	0.22	0.31
	N	250.00	174.00	47.00	39.00	27.00	13.00
Q2	Mean	4.80	4.94	4.89	4.31	4.48	4.69
	Std Err	0.10	0.12	0.20	0.24	0.38	0.35
	N	250.00	174.00	47.00	39.00	27.00	13.00
Q3	Mean	2.64	2.80	2.55	2.62	2.78	2.92
	Std Err	0.09	0.12	0.22	0.20	0.27	0.33
	N	249.00	174.00	47.00	39.00	27.00	13.00
Q4	Mean	4.08	4.12	3.63	3.79	3.81	3.54
	Std Err	0.10	0.13	0.21	0.28	0.27	0.51
	N	249.00	173.00	46.00	39.00	27.00	13.00
Q5	Mean	5.57	5.26	5.57	4.77	4.67	3.62
	Std Err	0.08	0.10	0.19	0.24	0.29	0.54
	N	250.00	174.00	47.00	39.00	27.00	13.00
Q6	Mean	5.55	5.32	5.66	4.92	4.56	5.00
	Std Err	0.08	0.11	0.16	0.24	0.29	0.42
	N	250.00	174.00	47.00	39.00	27.00	13.00
Q7	Mean	5.14	4.94	5.06	4.51	4.33	4.23
	Std Err	0.09	0.11	0.20	0.25	0.35	0.39
	N	250.00	174.00	47.00	39.00	27.00	13.00
Q8	Mean	2.53	2.90	2.85	3.34	3.41	3.92
	Std Err	0.09	0.12	0.23	0.24	0.28	0.35

	N	249.00	173.00	47.00	38.00	27.00	13.00
Q9	Mean	4.87	4.67	5.26	5.85	6.00	5.69
	Std Err	0.12	0.14	0.23	0.21	0.24	0.38
	N	250.00	174.00	47.00	39.00	27.00	13.00
Q10	Mean	3.88	3.71	3.96	4.26	3.89	3.77
	Std Err	0.10	0.12	0.21	0.28	0.32	0.34
	N	250.00	173.00	47.00	39.00	27.00	13.00
Q11	Mean	5.53	5.38	5.62	5.26	5.15	4.62
	Std Err	0.07	0.09	0.17	0.16	0.20	0.38
	N	248.00	173.00	47.00	39.00	27.00	13.00
Q12	Mean	5.15	4.93	5.19	4.62	4.48	4.75
	Std Err	0.08	0.10	0.19	0.21	0.25	0.37
	N	249.00	174.00	47.00	39.00	27.00	12.00
Q13	Mean	5.28	5.05	5.51	4.77	4.33	4.23
	Std Err	0.09	0.11	0.22	0.24	0.34	0.51
	N	250.00	174.00	47.00	39.00	27.00	13.00

MIDDLE TENNESSEE STATE UNIVERSITY

8/21/2014

Investigator(s): Emily Smith, Dr. Ryan Otter
Department: Biology
Investigator(s) Email Address: ess3a@mtmail.mtsu.edu; Ryan.Otter@mtsu.edu

Protocol Title: Comparing students' and professors' perceptions on the use of PowerPoint in biology classrooms in higher education

Protocol Number: #15-028

Dear Investigator(s),

Your study has been designated to be exempt. The exemption is pursuant to 45 CFR 46.101(b)(2) Educational Tests, Surveys, Interviews, or Observations.

We will contact you annually on the status of your project. If it is completed, we will close it out of our system. You do not need to complete a progress report and you will not need to complete a final report. It is important to note that your study is approved for the life of the project and does not have an expiration date.

The following changes must be reported to the Office of Compliance before they are initiated:

- Adding new subject population
- Adding a new investigator
- Adding new procedures (e.g., new survey; new questions to your survey)
- A change in funding source
- Any change that makes the study no longer eligible for exemption.

The following changes do not need to be reported to the Office of Compliance:

- Editorial or administrative revisions to the consent or other study documents
- Increasing or decreasing the number of subjects from your proposed population

If you encounter any serious unanticipated problems to participants, or if you have any questions as you conduct your research, please do not hesitate to contact us.

Sincerely,

Lauren K. Qualls, Graduate Assistant
Office of Compliance
615-494-8918

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