

North Central Region

Center for FSMA Training, Extension
and Technical Assistance

Produce Safety Alliance Grower Training Knowledge Assessment

NORTH CENTRAL REGION RESULTS

Manreet Bhullar, Arlene Enderton, and Bridget Perry, Iowa State University

Introduction

The rise in reported food-borne illness outbreaks has sparked an urgent need for transformation regarding the nation's food safety system. The focus of responding to a food-borne illness shifted to prevention when the Food Safety Modernization Act (FSMA) was passed by Congress and then in January 2011 signed into law by President Barack Obama. The law consists of seven rules, one of which is the Produce Safety Rule, which applies to those who grow, harvest, handle or pack fresh fruit and vegetables. One of the requirements of the Produce Safety Rule is that fruit and vegetable growers take an approved food safety course. The Produce Safety Alliance (PSA) Grower Training is offered by various University Extension programs and Departments of Agriculture.

The North Central Region Center for FSMA Training, Extension and Technical Assistance (NCR FSMA) evaluated these training using a knowledge assessment. This report shares the results from trainings held in year 1 (July 1, 2017-June 30, 2018) and year 2 (July 1, 2018-June 30, 2019).

Methods

The Knowledge Assessment was developed by Dr. Amy Harder, an evaluator for the Southern Center for Training, Education, Extension, Outreach, and Technical Assistance to Enhance Produce Safety.

The Knowledge Assessment consisted of 25 questions related to the seven modules of the PSA Grower Training. Training participants were asked to complete the quiz in writing before beginning the training and again after the training.

Trainers collected the paper copies from the participants and sent them to the NCR FSMA evaluation team. Data was entered into Qualtrics; an online data collection and analysis platform, to create the dataset. Pre-test and post-test responses were matched using a unique identification number written on each quiz, along with the date of the training, and the state.

Only responses which included both a pre-test and a post-test from the same person were included in the analysis. (In a few cases, a person completed only the pre-test or only the post-test.) We received 1519 complete responses from **93** trainings in the North Central Region (NCR) in the year 2, and 767 responses from **40** trainings in year one.

The NCR FSMA evaluation team analyzed the data using SPSS™. Each question was assigned to the related PSA Grower Training module, and a total score of correct answers was calculated for each module. (The module to which each question was assigned is listed in Appendix A.) The scores by module were averaged and rescaled from zero to five. Rescaling allowed the evaluators to compare participants' knowledge of each module with another.

In addition, trainers completed a cover sheet for each training and returned the cover sheet along with the pre-tests and post-tests. The cover sheets provided information including the date of the training, the location, names of trainers, the number of participants, and whether the training was targeted towards any special population. Special populations that we tracked included Plainclothes growers (which includes Amish and Mennonite growers), minorities, local food growers, military veterans, non-English/limited

English language, and other. Nine trainings held in NCR targeted Plainclothes growers, two targeted Non-English/Limited English proficiency speakers (Spanish), and one targeted minority growers. Nine trainings targeted other special populations, which included university students, professionals in food-adjacent industries, research or learning farm staff, or a mix of Plainclothes growers with English growers. The remaining trainings did not target any special population.

Results

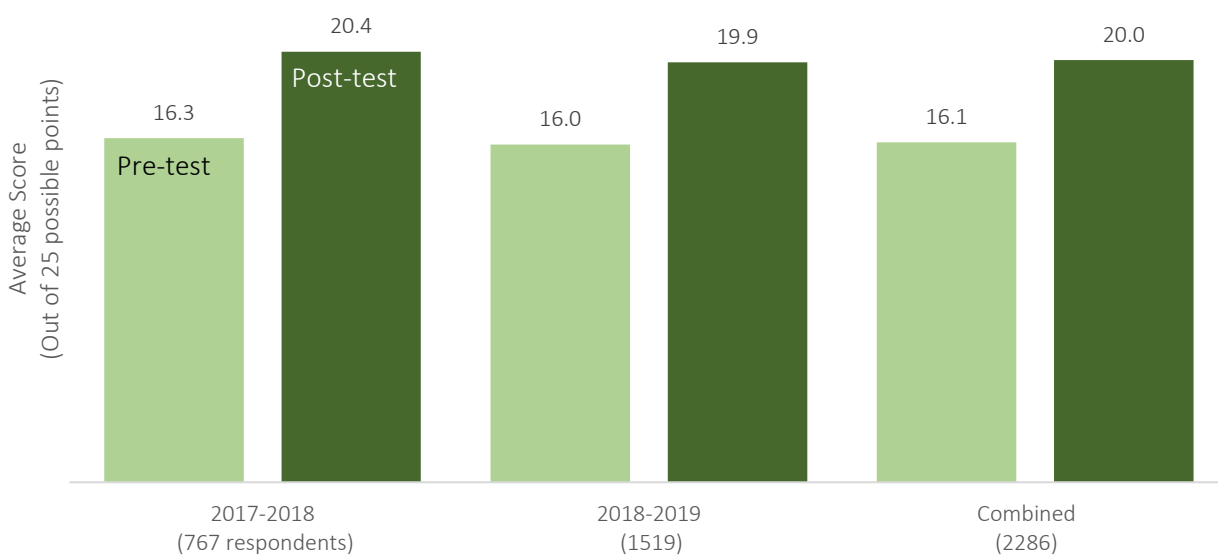
How much did respondents' food safety knowledge improve during the training?

Overall scores increased by an average of 3.9 points out of 25 possible from pre-test to post-test.

Respondents' knowledge of food safety and FSMA improved in the last two years of training. On average, respondents scores improved by 4.1 points (out of 25) from the pre-test to the post-test in year 1 and by 3.9 points in year 2 (Figure 1). This averages out to a 3.9 point increase across both years. The difference between pre-test and post-test scores is statistically significant at a level of $\alpha=0.001$ in year one and a level of $\alpha=0.05$ in year two. This means the differences pre-test and post-test scores are not likely due to chance, but to an actual difference between pre-test and post-test scores in the population.

Pre-test scores in year 2 (16.0 points) were slightly lower than pre-test scores in year 1 (16.3), which may indicate participants entered trainings with a slightly lower understanding of food safety and FSMA in year 2 than year 1, but the difference in scores was not statistically significant ($p=0.058$). Average post-test scores were also slightly lower in year 2 (19.9) than in year 1 (20.4), and the difference was statistically significant ($p=0.001$). It appears respondents' improvement in knowledge was lower in year 2 (3.9 points) than year 1 (4.1), but the difference is not statistically significant ($p=0.096$).

Figure 1: On average, scores increased more in year 1 than in year 2. (n=2286)

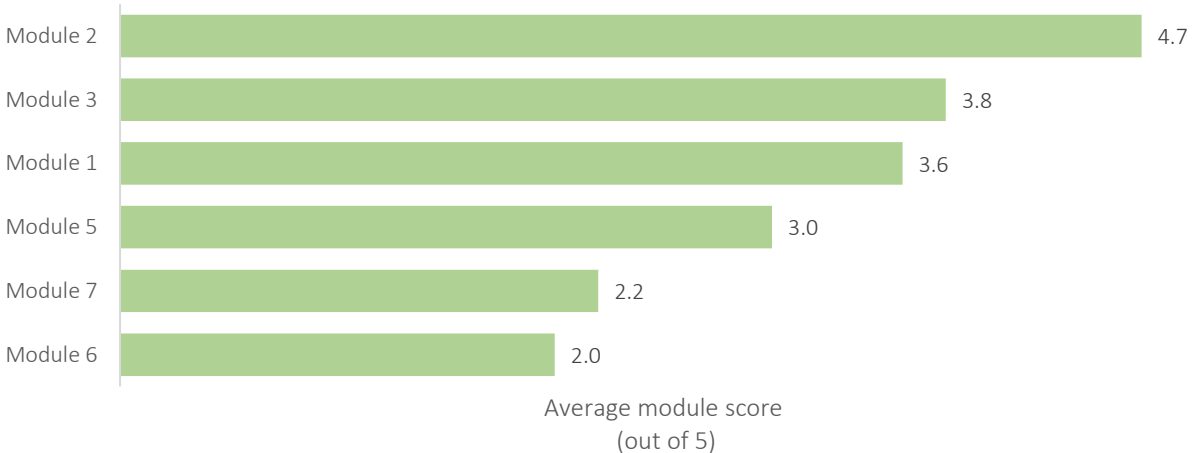


What baseline food safety knowledge did participants have before the training?

Participants were most familiar prior to the training with concepts related to worker health, hygiene, and training.

The pre-test is especially useful for determining training participants' baseline knowledge before the training, so trainers can know which modules may need more emphasis. In the NCR, in year 2 (2018-19) training participants came to the training with the highest baseline understanding of Module 2 (worker health, hygiene, and training), as shown in Figure 2. Therefore, future trainings may not need to emphasize this module as heavily. (However, the knowledge assessment only included two questions related to Module 2, making it harder to assess.) Respondents had the lowest baseline knowledge of Module 6 (post-harvest handling and sanitation) and Module 7 (how to develop a farm food safety plan).

Figure 2: Participant scored highest on Module 2 on the pretest. (n=1519)



How did participants score on the post-test?

Knowledge improved the most on wildlife, domesticated animals, and land use; and post-harvest handling and sanitation.

Figure 3 reports the participants' average post-test scores. Like on the pre-test, respondents scored highest on Module 2 (worker health, hygiene, and training) on the post-test.

Respondents scored lowest on the post-test on Module 7 (how to develop a farm food safety plan) in year 2, as shown in Figure 3. Only 34 percent of respondents answered question 24 (Figure 4) correctly on the post-test, making it the least understood question. This question is one of those which tests knowledge of Module 7. It asks which records are required by the FSMA Produce Safety Rule. The Produce Safety Alliance produced a handout entitled, "Records required by the FSMA Produce Safety Rule" ([Produce Safety Alliance, 2018](#)) which may help growers understand this module better. If not already doing so, NCR trainers may want to include this handout in the materials they provide to growers.

Figure 3: Participants scored highest on Module 2 on the post-test. (n=1519)

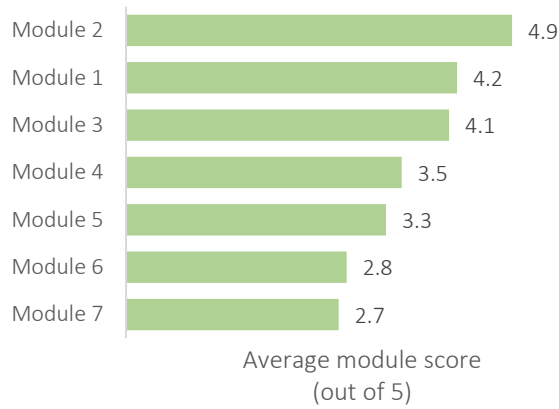


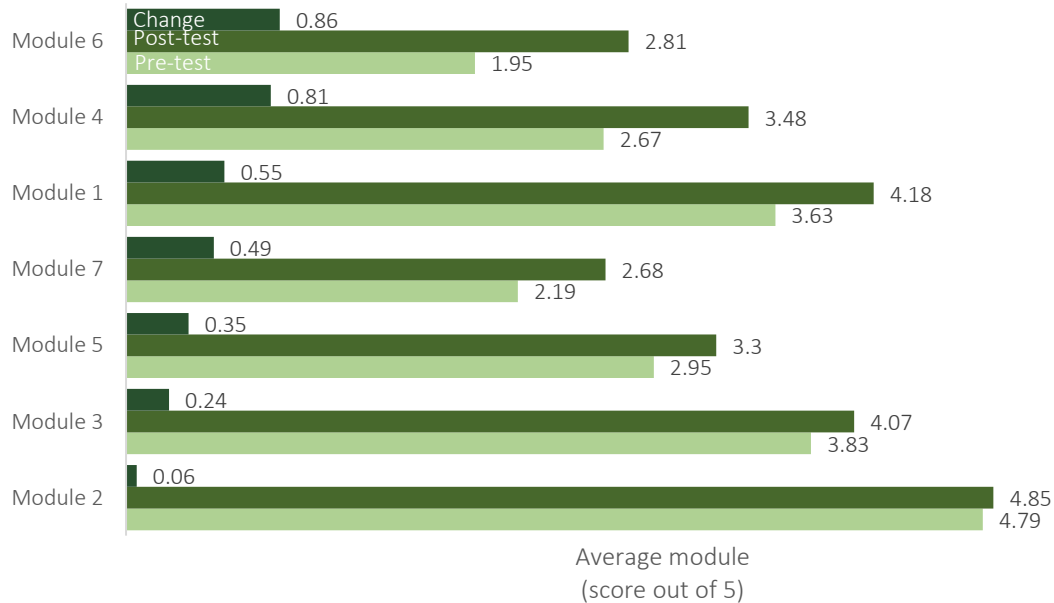
Figure 4: Question 24 was the question most often answered incorrectly on the post-test.

Which of the following records is required by the FSMA Produce Safety Rule?

- a. Worker training dates
- b. Water change schedules
- c. Soil amendment applications
- d. Management of sanitary facilities

When the post-test scores were compared to the pre-test, it showed the greatest gain in knowledge on Modules 4 and 6, about wildlife, domesticated animals, and land use; and post-harvest handling and sanitation (Figure 5). Not surprisingly, they gained less knowledge on Module 2, as this was the module about which they already had a higher understanding before the training.

Figure 5: Scores improved most on Modules 6 and 4 (n=1519)



How did scores differ by training location?

It appears special populations had lower knowledge of FSMA and food safety prior to the training and learned less at the training than general populations.

First, incoming levels of food safety knowledge varied greatly across locations, with average pre-test scores ranging from 15.4 points in Missouri to 18.9 points in South Dakota (Figure 6). Score change also varied widely, from a 0.9 point increase in South Dakota to 4.6 points in Kansas (Figure 7). The average score change at the South Dakota trainings was the lowest, but on average participants at this training had the highest pre-test score and the highest post-test score. Therefore, their score change was lowest, because they had the least room to improve their already high pre-test score.

Figure 6: Incoming knowledge varied greatly between trainings. (n=1,490)

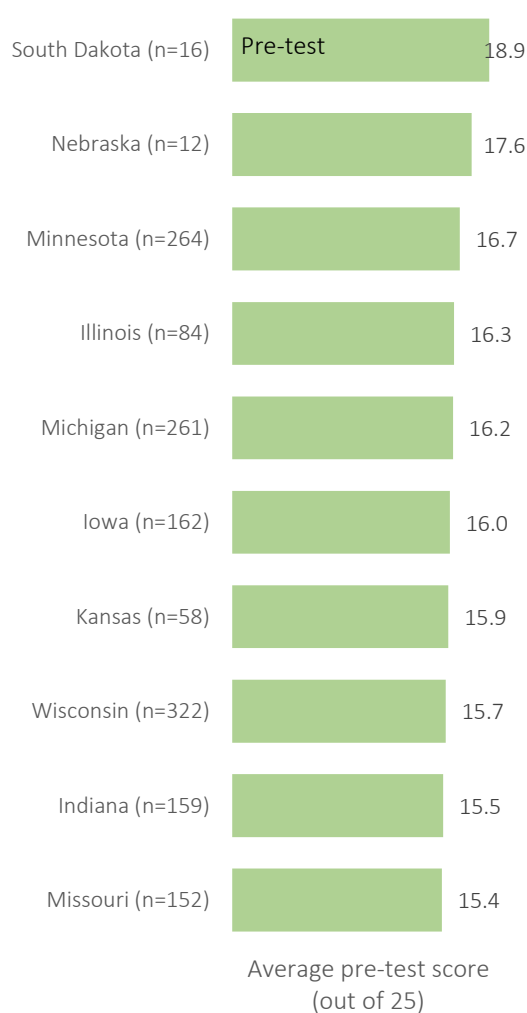
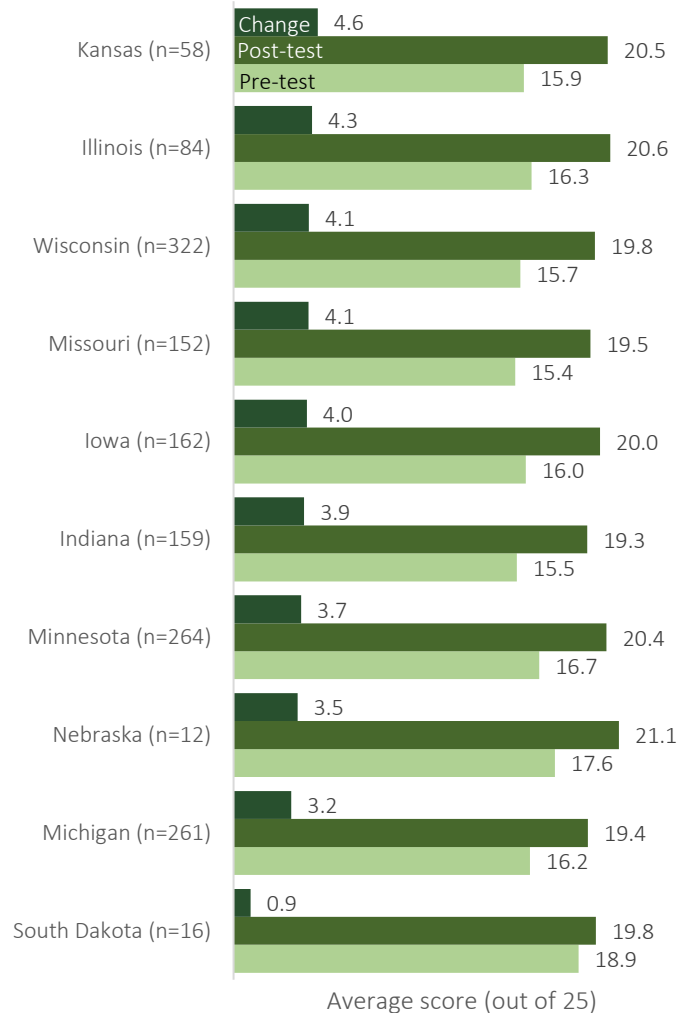


Figure 7: Scores Improved the most at the trainings in Kansas and Illinois in year 2.

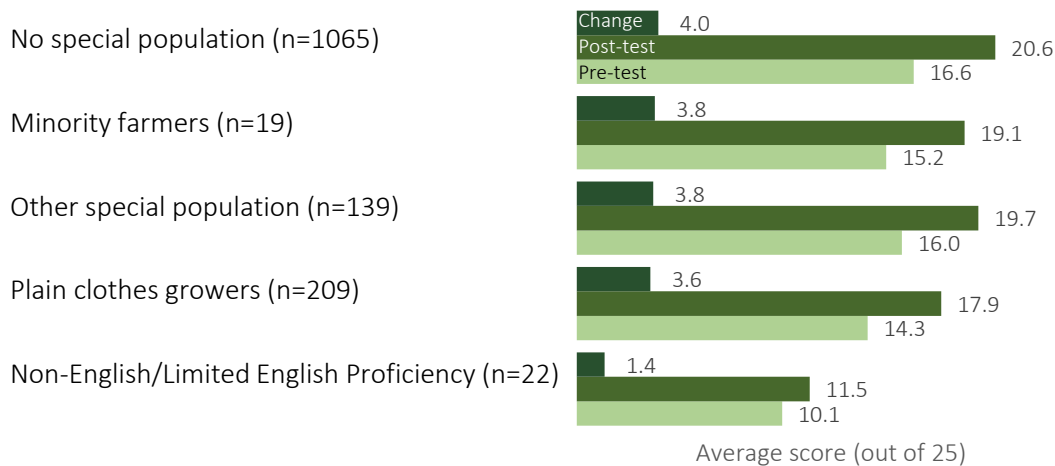


The cover sheets for the trainings held in NCR in year 2 indicated that 21 of the trainings targeted a special population. Nine trainings targeted Plain (Amish and Mennonite) growers (Indiana, Iowa, Wisconsin), two trainings reached Non-English English/Limited English proficiency (Spanish) growers (Michigan), and one targeted minority growers (Kansas). Nine trainings were held for other special populations (Illinois, Iowa, Missouri South Dakota, and Wisconsin). Eleven of the trainings targeting special populations had the lowest average pre-test scores.

Figure 8 shows how the 21 trainings targeting special populations compare with those that did not target any special population (72 trainings). It shows that participants in training targeting special populations, on average, had lower pre-test and post-test scores and lower average score change. This may indicate growers who attended trainings for special populations had a lower knowledge of food safety and FSMA prior to the training than other growers. It also may indicate that having a lower incoming knowledge disadvantaged these growers, making it harder for them to understand the training and glean new knowledge to the same degree as other growers. If this is the case, trainers may want to consider offering a more basic food safety course to special populations prior to taking the PSA Grower Training to give them a stronger baseline knowledge of food safety prior to taking the training.

Alternatively, one may conclude that the knowledge assessments instruments or protocol somehow disadvantaged special populations and did not accurately measure their knowledge.

Figure 8: Special populations did not score as well as non-special populations.



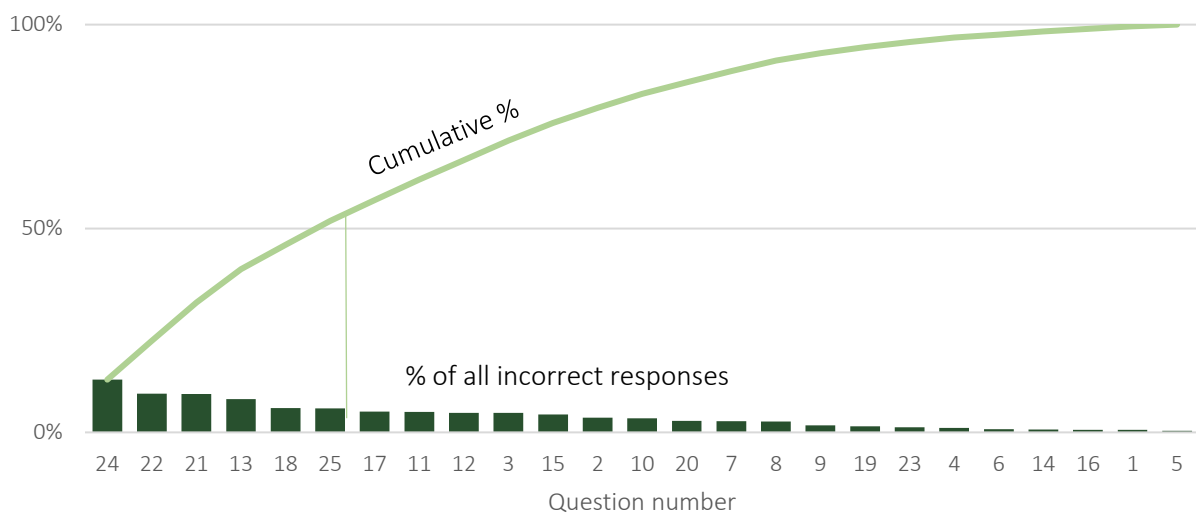
Which concepts continued to be unclear after the training?

Many of the questions that were frequently answered incorrectly in year 1 on the post-test continued to be frequently missed in year 2.

Figure 9 shows the questions which respondents most often answered incorrectly on the post-test in year 2. Six questions account for over half of all incorrect responses: questions 12, 13, 18, 21, 22, and 24.

These same questions were often answered incorrectly in year 1. Following year 1, trainers from the North Central Region discussed how they might better deliver the training to improve understanding of the concepts covered by these questions. However, year 2 data showed that respondents continued to answer these questions correctly at similar rates as they did in year one. Therefore, we might conclude that these questions are “tricky” and improving scores may depend just as much on rewriting the questions as in delivering a higher quality training. For example, after year 1, trainers agreed that question 13 was poorly worded, so improvement was limited by the NCR FSMA’s inability to modify the evaluation instrument, because the survey is being used nationally.

Figure 9: Over half of all incorrect responses on the post-test were from 6 questions.



Conclusions and recommendations

While many factors contribute to respondents’ scores on the PSA Grower Training Knowledge Assessment, such as trainer competency, course content and the quality of the assessment tool, NCR trainers may be able to further contribute to participants’ knowledge gain by adjusting strategies. These recommendations flow from evaluation summarized in this report:

If not already doing so, include the following Produce Safety Alliance handout with training materials: “Records required by the FSMA Produce Safety Rule.” Perhaps dedicate time during the training to review the handout and answer any questions regarding the content.

Consider offering a basic food safety course to special populations growers prior to taking the PSA Grower Training to give them a stronger baseline knowledge of food safety prior to taking the training.

Module 7 had one of the lowest pre-test scores, on average, and only moderate score change from pre-test to post-test. Discuss how module 7 might be better presented, given the challenges of teaching this final module at the end of a long day of training.

Appendix A: Individual questions, NCR Results

Question	2017-18		2018-19		Assigned Module
	Pre-test % Correct	Post-test % Correct	Pre-test % Correct	Post-test % Correct	
1	94.0%	97.4%	93.0%	96.8%	1
2	60.0%	81.6%	63.1%	81.4%	1
3	67.9%	79.7%	66.2%	75.6%	1
4	83.2%	95.3%	79.0%	94.3%	1
5	97.5%	98.6%	97.4%	97.8%	2
6	94.1%	96.6%	93.1%	96.2%	2
7	77.7%	89.4%	73.9%	86.0%	3
8	77.2%	87.6%	75.1%	86.5%	3
9	83.8%	91.0%	82.7%	91.0%	3
10	72.9%	88.3%	70.9%	82.1%	3
11	52.3%	78.6%	46.9%	74.1%	4
12	84.6%	84.0%	80.5%	75.3%	3
13	40.2%	59.1%	36.7%	58.0%	4
14	71.8%	91.9%	76.6%	96.2%	4
15	64.0%	79.3%	61.5%	77.6%	5
16	90.2%	95.7%	92.0%	96.6%	5
17	24.8%	70.5%	23.7%	74.0%	5
18	65.3%	73.8%	61.6%	69.6%	1
19	50.2%	92.8%	57.0%	92.4%	6
20	58.1%	87.4%	52.2%	85.4%	6
21	47.7%	51.9%	46.5%	51.6%	6
22	8.1%	61.0%	5.7%	51.1%	7
23	82.7%	90.6%	82.6%	93.5%	7
24	33.1%	49.7%	33.6%	33.7%	7
25	52.3%	69.4%	53.3%	69.7%	7
TOTAL	65.4%	81.6%	64.0%	79.6%	
	Pre-test	Post-test	Pre-test	Post-test	
Most often correct	Question 5	Question 5	Question 5	Question 5	
Least often correct	Question 22	Question 24	Question 22	Question 24	