Teacher Content Knowledge was measured three times as part of the teacher survey, before and after the workshop as well as after the Capstone Symposium. Students were measured upon consent prior to group randomization and after the Capstone Symposium. The same set of questions was used for teachers and for students.

Participants were asked to complete two sets of 10 True/False questions to assess their knowledge of bioinformatics and genome annotations at the start and end of the summer training workshop. The ten questions included in Set 1 were developed by the Microbial Genome Annotation Network (MGAN) to assess learning in students who used IMG-ACT (later GENI-ACT) within their courses. Set 2 includes 10 supplemental items developed by Dr. Koury to help assess learning specific to the program.

Teachers' responses were scored with 1 point awarded for each correct answer, up to 10 points for each set of 10 knowledge questions. The mean number correct was compared across treatment group, time point and set of questions using t-tests and ANOVAs.

Sample item analysis based on teacher workshop in year 3.

Content Knowledge by Item

Item Set 1	Correct Response	N	Pre-Workshop Count Correct	Pre-Workshop Percent Correct	N	Post-Workshop Count Correct	Post-Workshop Percent Correct	Change
A gene encodes a protein.	FALSE	31	3	10%	30	2	6.7%	-1
Each gene has its own unique promoter.	FALSE	31	5	17%	30	11	36.7%	6
Each gene encodes an RNA.	TRUE	31	21	70%	30	9	30.0%	-12
If translated, the DNA sequence of the gene controls protein structure and function.	TRUE	31	26	87%	30	28	93.3%	2
A gene is transcribed.	TRUE	31	25	83%	30	28	93.3%	3
If translated, the DNA sequence of a gene has no impact on the cellular localization of the encoded protein.	FALSE	31	21	70%	30	25	83.3%	4
Each gene has its own Shine-Dalgarno sequence.	FALSE	31	2	7%	30	20	66.7%	18
If translated, any change in the DNA sequence of the gene leads to a change in the amino acid sequence of the encoded protein.	FALSE	31	14	47%	30	18	60.0%	4
A gene's DNA sequence is usually no more closely related to DNA sequences from its closest relatives than to DNA sequences of unrelated organisms.	FALSE	31	20	67%	30	25	83.3%	5
A gene has homologs in other organisms.	TRUE	31	20	67%	30	25	83.3%	5

Content Knowledge by Item

Item Set 2	Correct Response	N	Pre-Workshop Count Correct	Pre-Workshop Percent Correct	N	Post-Workshop Count Correct	Post-Workshop Percent Correct	Change
There are 6 possible reading frames for protein translation for any double stranded DNA molecule.	TRUE	31	2	7%	30	26	86.7%	24
The line below is the correct format for a FASTA header that is added to the beginning of a DNA or amino acid sequence prior to computer analysis. o >Ksed_00010 nucleotide sequence	TRUE	31	1	3%	30	28	93.3%	27
T-Coffee analysis predicts the cellular location of a gene product.	FALSE	31	0	0%	30	19	63.3%	19
A Shine-Dalgarno sequence in bacterial DNA indicates the site where DNA polymerase binds to start DNA replication.	FALSE	31	2	7%	30	7	23.3%	5
A signal peptide directs proteins to be secreted from the cell in bacteria.	TRUE	31	4	13%	30	26	86.7%	22
Refer to the TMHMM output below. The results indicate that the protein being analyzed is located outside of the cell.	FALSE	31	0	0%	30	10	33.3%	10
An EC number is used to describe the function of an enzyme.	TRUE	31	3	10%	30	21	70.0%	18
All genes in a bacterial genome are functional.	FALSE	31	20	67%	30	28	93.3%	8
Some genes in a species of bacterium may have been obtained from an entirely different species of bacterium without being inherited.	TRUE	31	24	80%	30	30	100.0%	6
Gene annotation is the process of assigning function to a particular DNA sequence.	TRUE	31	22	73%	30	29	96.7%	7