

The Use of Current Events to Enhance Student Learning in Agricultural Genetics¹

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Abstract

Many students enrolled in undergraduate genetics courses have difficulty relating concepts taught in class to real-world applications in agriculture. The objective of this study was to determine if incorporating a current events assignment improved student learning in an undergraduate genetics class. Students were either assigned no current events projects (fall 2012), five papers on any species (fall 2013), four papers with evenly distributed due dates on agricultural species (spring 2015), or a group video-based assignment on any species (fall 2016). Students took a pre- and post-test to measure improvement in knowledge during the semester. Students in all semesters exhibited improvement in knowledge, but there was no clear pattern of improvement due to incorporation of current events assignments. Even though this is an agricultural genetics class, students tended to choose articles based on humans, indicating lack of reading on their chosen subject of study. Although the result was not consistently reflected in objective measures of achievement, students perceived both paper and video assignments as moderately helpful in reinforcing course content. Students rated the video assignment as slightly more helpful than the papers, but this result may be because students also tended to rate the video assignment as highly enjoyable.

Introduction

Genetics is among the subjects that biology teachers rank as most important and most difficult for high school students to learn (Stewart, 1982; Johnstone and Mahmoud, 1980). Science educators have been encouraged to utilize strategies that provide students an opportunity to relate abstract scientific ideas to real-world applications, because these types of activities should assist students in gaining long-term knowledge and skills (Allen and Tanner, 2005). Incorporating evaluation of current events that relate to subjects taught in class has the potential to help reinforce learning in the classroom. Genetics is a rapidly-evolving field, and is featured in the

mainstream and agricultural press almost daily. There is little information in the literature describing the effect of incorporating current events into the classroom. A study conducted at a pharmacy school suggested that writing a current events paper helped increase students' understanding of the material (Kelsch, 2010). The incorporation of current events or news articles into the curriculum may also have other advantages, because much of an individual's knowledge of advancements in science will come through the media, and not through a classroom or textbook (Kachan et al., 2006). Teaching students to critically evaluate the stories they encounter in the media and giving them the opportunity to practice integrating classroom knowledge into what they read in print and online media should help them make value judgments based on scientific information in the future.

There are many ways that current events can be incorporated into the classroom. This study compares two different approaches: writing papers individually versus a team-based video project. In-class writing assignments administered in animal science courses have been shown to increase perceived ability to express ideas in writing and more confidence in writing graded compositions (Trojan et al., 2016). Because 58% of students indicated that writing assignments helped them better understand the course material and 65% rated them relevant and useful to overall learning, Trojan et al. (2016) concluded that writing assignments were a successful mechanism for increasing writing skills and enhancing comprehension of the course content. With the writing assignment described in this study (Trojan et al., 2016), students are required to analyze a number of articles, and their individual understanding of the content and topic can be assessed. In contrast, the team-based video assignment does not allow for this type of individualized assessment for each student. However, it does incorporate peer-assisted learning, which has been shown to be an effective way to promote achievement, and fosters the ability for students to work collaboratively with one another (Schunk, 2012). Further,

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it has been suggested that team-based learning has a positive impact on development of “soft skills” that are important in the workplace as well as enhancing student enjoyment (Artz et al., 2016).

The objective of this study was to determine if the incorporation of current event papers or a group video project into the curriculum enhanced student learning in agricultural genetics.

Materials and Methods

In the Department of Animal Sciences and Industry (ASI) at Kansas State University (K-State), Genetics is a sophomore/junior level class that is required for all ASI majors. It has a prerequisite of a general biology course (general zoology or botany) and itself is a prerequisite for Animal Breeding Principles, which focuses on applications of quantitative genetics. Genetics is also a service course for the College of Agriculture, as it is required by some options in the departments of Agronomy and Horticulture, and is a choice as an agriculture elective for other majors, such as Agricultural Economics and Agricultural Communications. Therefore, while the majority of enrolled students are ASI majors, there are many different agricultural disciplines represented.

Course Content

This genetics course consists of four major units. Unit 1 is Mendelian inheritance, including sex-linkage, epistasis, and pedigree analysis. Unit 2 covers chromosome structure, DNA structure, and DNA replication. Unit 3 is transcription, translation, regulation of gene expression, and biotechnology. Unit 4 is genomics, quantitative genetics, and population genetics. At the beginning of each unit for fall 2012 (f12), fall 2013 (f13) and spring 2015 (s15), a pretest was given. In fall 2016 (f16), the pre-test was made available before the course began, and had to be completed before the end of the first week of class. The students were not graded on the test, but were given points for attempting all questions. At the end of each unit a unit exam was given that counted towards their final grade. In f12, students' overall grades were a combination of weekly homework, unit exams, participation points for completing the pretests, and group problems done in class. To provide real-world applications for genetics concepts, a current events assignment was subsequently incorporated into the Genetics course. Thus, in f13, all the previous grade components were included, plus five current event papers due at the end of the semester. The same components were included in s15, except the number of current events papers was decreased to four and the papers were due at various times during the semester instead of all at the end. Another change implemented in s15 was to require the topic to be livestock, companion animal, exotic animal, or crop genetics. Articles dealing with human genetics were not allowed. A new instructor in f16 implemented a group video project to replace the current events articles. Course components in f16 included four regular

unit exams, an optional cumulative final, participation in review question wikispaces, weekly homework assignments, and the current events video project. Students who completed the pre-test before the deadline received five bonus points for the course. These semesters were chosen for inclusion in this analysis because they had both the pre-test and the survey administered at the end of the course.

Current Events Papers

In f13, students were asked to find five popular press articles that related to genetics. Articles could come from any reputable print or online source, and could pertain to any livestock, companion or exotic animal species, any crop or horticultural species, or humans, and had to be from the current year. For each article, students were required to submit a one-page paper describing the article and explaining how it related to concepts covered in class. To maintain flexibility, the only due date given was that all five papers had to be turned in before the week of final exams. The intention was to give the students the opportunity to do a paper whenever they happened across an article about genetics in their regular reading. In s15, the article had to pertain to any livestock, companion or exotic animal species, or any crop or horticultural species (not human). There were only four articles assigned and the due dates were evenly distributed throughout the semester.

Current Events Videos

For the video assignment, students worked in groups of approximately ten, and were allowed to choose their own group members. Groups of ten were used to balance the size of the class and number of videos to be watched in a class period. The group had to choose one article in the popular press that pertained to a genetics topic and had been published in the preceding year. Each group was responsible for developing a three to five-minute video that described the article. Videos were evaluated on adherence to the time requirements, how well they explained the article's content, accuracy in depicting the scientific concept in the article, and the students' creativity in presenting the content. Groups could submit their videos early for review and feedback, and final versions were due at the beginning of the week before final exams. All videos were viewed during a single class period and students were provided the opportunity to evaluate their group members' contributions to the video to ensure that all students contributed to making the video, and do a peer evaluation of the videos of other groups. Both of these components, along with meeting deadlines for group formation and article selection and the instructor's evaluation of the video were included in the final grade for the video.

Data Collection

This study was considered exempt by the K-State Institutional Review Board. Data collected from each semester included student performance on pre-tests

Figure 1. Survey Provided to Students at the End of the Semester Regarding Current Event Papers or Video Assignments

On the following list, put a 1 and 2 in the blanks of your primary and secondary species of interest.

_____ Beef
 _____ Cat
 _____ Crops, agronomy (corn, beans, wheat etc.)
 _____ Crops, horticulture (fruit, vegetables, flowers, etc.)
 _____ Dairy
 _____ Dog
 _____ Exotic animals (zoo, wildlife)
 _____ Goat
 _____ Horse
 _____ Human
 _____ Poultry
 _____ Sheep
 _____ Swine
 _____ Other (please indicate _____)

How many magazine/newsletters/periodicals (print or electronic) related to your specie(s) of interest do you read regularly?

Did you (circle one):
 a. finds the majority of articles for class in your regular reading?
 OR
 b. specifically goes looking for articles just to complete the assignment?

On a scale from 1-5 with 1 being not helpful at all and 5 being extremely helpful, how useful were the current events assignments in learning and reinforcing the concepts discussed in class?

Comments on current events assignment:

and exams, as well as results from a survey filled out by students after completing the current events assignments or video project in f13, s15, and f16. There was no current events assignment in f12, which serves as the control. Students were removed from the dataset if they failed to complete the course, which was defined as not taking any of the four exams. There were 128, 130, 139, and 151 students that completed the course in f12, f13, s15, and f16, respectively. The improvement from pre-test to unit exam for each unit was calculated by subtracting the score on pre-test questions from the score for the same questions asked on unit exams. Student cumulative grade point average (GPA), calculated the semester after taking genetics, was obtained from the student records system. Many incoming transfer students take this course their first semester, so GPA information before taking Genetics was not available for all students. The dates the current events papers were turned into the online system were recorded, as well as species discussed in the articles for both paper and video assignments. The post-course survey (Figure 1) consisted of questions regarding primary and secondary species of interest, number of periodicals pertaining to their species of interest (newsletters, magazines, etc.) the student regularly reads, how the article for the assignment was identified, a rating describing how useful they felt the assignment was in reinforcing course content, and comments about the assignment.

Statistical analyses were performed using SAS 9.4 (SAS Institute Inc., Cary, NC). Improvement from pre-test to exam was analyzed with a general linear model that included semester as a fixed effect and GPA as a covariate. Differences in survey responses were determined with a chi-square test.

Results and Discussion

Students did not significantly differ in their average overall cumulative GPA between f12 (2.98), f13 (2.99), s15 (3.10), and f16 (3.06) ($P > 0.14$). This would indicate that students in all years had approximately equal overall academic ability. Average final percentage in the course was lower in f16 (60.21, $P < 0.01$) than in f12 (76.01), f13 (75.62), and s15 (77.24), which were like each other ($P > 0.29$). These differences are likely due to differences in instructors, but did not necessarily reflect differences in final letter grades in the course as the grades were curved. Improvement from pre-test to unit exam for the four units, as well as average improvement over all units for both years is shown in Table 1. Overall, there was a very inconsistent pattern of improvement between the units and semesters. For unit 1, unit 4, and overall average, students without current events papers or a group video assignment improved more than other students (Table 1). For unit 2, students that had current events articles due at the end of the semester and students that did the group video project improved more than students with no additional assignments (Table 1). In unit 3, students with no additional assignment and students that did current events papers improved more than students that did a group video (Table 1).

These results indicate that the current event papers or group video did not consistently improve student learning throughout the course as measured by improvement from pretest to unit exam. This disagrees with the findings of Kelsch and Werremeyer (2010), who found that student learning was improved by incorporating current events into the classroom. It is possible that providing more guidance to students in selecting current events papers that directly address the most important topics in the course may be more beneficial to students. It is also possible that student learning did improve for the topics covered in the articles, but because topics were not the same for all students, the improvements were masked in the data. In addition, the timing of the current events papers in f13 may explain why they did not improve student learning. All papers were due the last day of class. Maximum flexibility was given so that students could submit articles that they came across in their regular reading. Figure 2 shows the distribution of the day of the semester that papers were submitted. In 2013, the first day of the semester was August 26,

Table 1. Least-Square Means for Improvement from Pretest to Unit Exam for Units 1-4, as well as Average Improvement over all Four Units for Fall 2012 (f12) Fall 2013 (f13), Spring 2015 (s15), and Fall 2016 (f16)^z

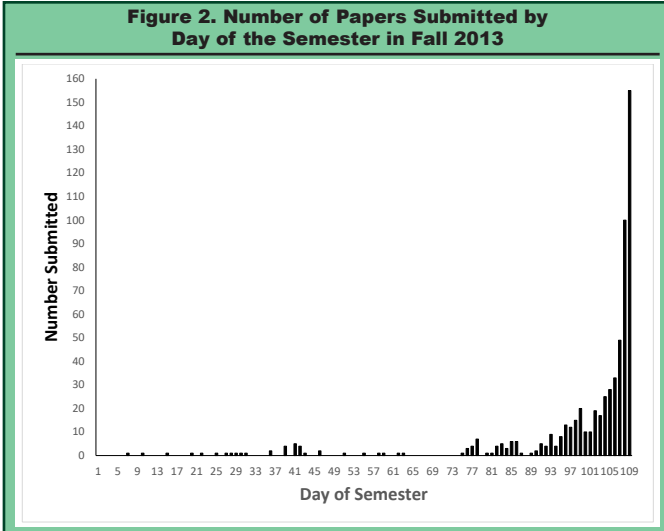
	f12	f13	s15	f16	Overall P-value
Improvement Unit 1	45.4 ^c	17.1 ^a	27.1 ^b	14.1 ^a	< 0.01
Improvement Unit 2	33.7 ^a	39.8 ^b	36.6 ^{ab}	37.5 ^b	0.17
Improvement Unit 3	37.0 ^c	30.5 ^b	40.5 ^c	15.9 ^a	< 0.01
Improvement Unit 4	39.9 ^c	21.5 ^a	28.1 ^b	24.6 ^{ab}	< 0.01
Average Improvement	39.4 ^d	26.6 ^b	32.8 ^c	22.442 ^a	< 0.01

^{abc}Means within a row with a different superscript are different ($P < 0.05$).

^zAssignments were: no current events (f12), current events papers due at the end of the semester (f13), current events papers due throughout the semester (s15), and current events video (f16)

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Figure 2. Number of Papers Submitted by Day of the Semester in Fall 2013



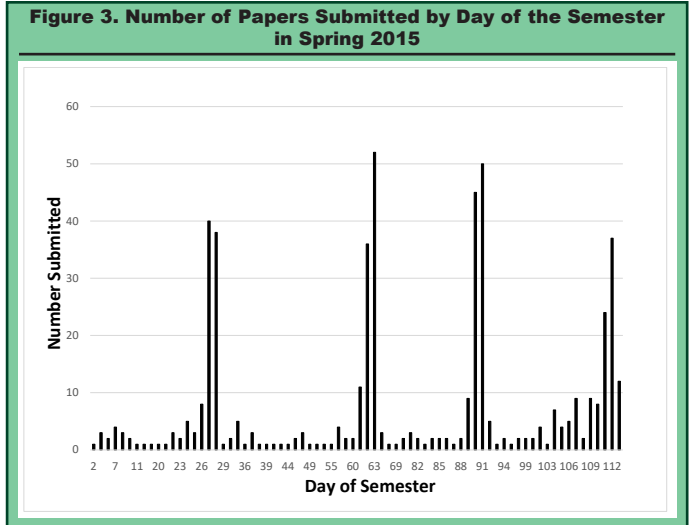
and the current events articles were due December 13, which was 109 days later. Students overwhelmingly chose to wait and submit all five of their papers at the very end of the semester. In fact, 72.4% of papers were submitted after Thanksgiving, which was two weeks before the end of class. Furthermore, 59.3% were submitted in the last week, including 25.2% submitted on the very last day. If student learning did actually improve as a result of reading current events articles, it would not show up in improvement from pre-test to unit exam for any unit except perhaps unit 4 because of the timing of the submissions. In addition, there is partial confounding with instructor and type of assignment. It could be that the difference in instructor contributed to some of the differences observed for the video assignments.

Figure 3 shows the distribution of submission day for the papers in s15. Even with staggered due dates, students submitted papers the last day or two before each deadline, which coincided with exam times. Increased improvement in exam scores was not demonstrated as consistently in s15 (Table 1).

Similar to f13, the video assignments in f16 were due at the end of the semester, and students likely did not work on them until at least unit 3. Articles were chosen by the end of unit 2, but may not have been thoroughly researched at that point. It is interesting to note that in the two semesters where significant project outcomes (five articles or the group video) were due at the end of the semester (f13 and f16), improvement in performance for unit 3 and 4 was lower than semesters where there were no current events assignments or where they were spread throughout the semester. It is possible that the current events articles and videos did have a positive impact on learning, but that it was not reflected in exam scores because a larger number of students spent more time at the end of the semester working on the papers and project and spent less time studying for those exams, thus negating the positive impact of the assignments.

Neither the papers nor the video assignment appeared to consistently improve student learning over the entire semester. There are several possible reasons.

Figure 3. Number of Papers Submitted by Day of the Semester in Spring 2015



Perhaps pre-test to unit exam improvement is not an accurate measure of student learning. The timing of submissions in f13 and f16 (everything put off to the end of the semester) reduced the possibility of the assignments improving student learning for earlier units. Finally, even with staggered due dates, finding, reading, and writing the current events paper may have taken time away from studying immediately before the unit exams for students that did not plan ahead effectively.

On the end of the semester survey, students were asked if the current events articles or group video project were helpful in learning and reinforcing class concepts (1=not helpful at all, 5=very helpful). Distribution of responses is shown in Table 2. The distribution of responses was different in f16 than in f13 or s15 ($P < 0.01$). Students rated the video project more helpful than the current events papers, even though this result is largely inconsistent with the numeric improvement outlined in Table 1. Least squares means for this response showed a similar result, being higher in f16 (3.38, $P < 0.01$) than in f13 (2.89) and s15 (2.76). It is possible that the difference in instructor contributed to the difference in perceived learning. Additional survey questions asked in f16 illustrated the discrepancy between perceived learning and achievement on exam questions even more clearly, with approximately 56% of students rating the amount they learned from making their own group's video at 8 or greater out of 10 (18.7% rated 10/10), and approximately 60% of students rating the amount they learned from watching other group's videos at 8 or greater out of 10 (22.8% rated 10/10). Student responses indicated that both assignments were only moderately effective in helping students learn the concepts from class, but the video project was rated as more effective than the papers.

To further examine student choice for submission of assignments, the species discussed in the chosen articles or videos was analyzed. Tables 3-5 show the number and percentage of students with interest in various agricultural or companion species (students could select more than one species) for the three semesters. All students were enrolled in the College of Agriculture,

Table 2. Student Responses to Survey Question: On a scale from 1-5 with 1 being not helpful at all and 5 being extremely helpful, how useful were the current events articles/video in learning and reinforcing the concepts discussed in class?

Student Response	Fall 2013 ^a		Spring 2015 ^a		Fall 2016 ^b	
	Number	%	Number	%	Number	%
1 not helpful	17	16.2	25	19.7	3	2.2
2	19	18.1	28	22.1	20	14.9
3	36	34.3	42	33.1	51	38.1
4	25	23.8	17	13.4	42	31.3
5 extremely helpful	8	7.6	15	11.8	18	13.4

^{a,b}Different superscripts for semesters indicate difference in frequency of responses (Chi-square P-value<0.01).

Table 3. Number and Percentage of Students Indicating Primary or Secondary Interest in Various Species (students could choose more than one species) and Number and Percentage of Articles Submitted Dealing with Those Species for Fall 2013

Species	Number of students	%	Rank	Number of articles	%	Rank ²
Beef	81	61.8	1	35	6.0	2
Cat	50	38.2	4	2	0.4	9
Crops – agronomy	50	38.2	4	29	5.0	4
Crops – horticulture	39	29.8	10	13	2.3	7
Dairy	50	38.2	4	7	1.2	8
Dog	72	55.0	3	18	3.1	6
Exotic	46	35.11	7	30	5.2	3
Goat	39	29.8	10	1	0.2	11
Horse	73	55.7	2	25	4.3	5
Human	45	34.4	8	321	55.4	1
Poultry	36	27.5	13	1	0.2	11
Sheep	39	29.8	10	0	0	13
Swine	40	30.5	9	2	0.4	9

²There were 95 articles (16.4%) that covered a general topic and didn't relate to any species.

Table 4. Number and Percentage of Students Indicating Primary or Secondary Interest in Various Species (students could choose more than one species) and Number and Percentage of Articles Submitted Dealing with Those Species for Spring 2015

Species	Number of students	%	Rank	Number of articles	%	Rank ²
Beef	84	63.6	1	136	26.1	1
Cat	23	17.4	7	10	1.9	9
Crops – agronomy	36	27.3	4	90	17.3	2
Crop – horticulture	18	13.6	8	18	3.5	8
Dairy	18	13.6	8	22	4.2	6
Dog	42	31.8	2	28	5.4	4
Exotic	27	20.5	5	75	14.4	3
Goat	12	9.1	12	5	1.0	13
Horse	42	31.8	2	27	5.2	5
Human	15	11.4	10	7	1.3	11
Poultry	10	7.6	13	8	1.5	10
Sheep	15	11.4	10	7	1.3	11
Swine	27	20.5	5	19	3.7	7

²There were 69 articles (13.2%) that covered a general topic and didn't relate to any species.

Table 5. Number and Percentage of Students Indicating Primary or Secondary Interest in Various Species (students could choose more than one species) and Number and Percentage of Videos Submitted Dealing with Those Species for Fall 2016

Species	Number of students	%	Rank	Number of videos	%	Rank
Beef	79	59.4	1	4	25.0	1
Cat	29	21.8	6	0	0	–
Crops – agronomy	24	18.1	8	0	0	–
Crops – horticulture	24	18.0	9	0	0	–
Dairy	23	17.3	10	2	12.5	4
Dog	55	41.4	2	2	12.5	4
Exotic	37	27.8	4	3	18.8	3
Goat	23	17.3	10	1	6.3	6
Horse	52	39.1	3	0	0	–
Human	27	20.3	7	4	25.0	1
Poultry	19	14.3	13	0	0	–
Sheep	22	16.5	12	0	0	–
Swine	37	27.8	4	0	0	–

which would presume a major interest in some plant or animal species. However, the vast majority of articles submitted in f13 were related to human genetics (Table 3). The current events assignment in s15 prohibited using articles from human genetics to encourage students to spend more time reading about their species of interest. Table 4 lists the species interest for students and the paper topics for s15. Topic of papers was much more closely aligned with stated interest of the students.

In f16, there was no restriction on species topic of the videos, and humans and beef were the subjects of the most videos (Table 5). However, video topics selected did not mirror students self-reported species interest- beef was rated as first for self-reported student interest, and humans was seventh (Table 5). This, combined with the submission dates for f13, indicated that students went looking on the internet for anything related to genetics as the due date approached. Human genetic issues are often covered by major news outlets, and are the top hits when genetics is searched on the web.

This project has revealed a potential deeper issue among our students. If a student was regularly reading agricultural publications or newsletters, they would have no problem finding articles dealing with genetics in their species of interest in the course of a semester. It appears that students are not reading trade publications on a regular basis or keeping up with current events in their chosen fields. This was the motivation to eliminate human genetics as an option in s15. Subsequent results for s15 were encouraging, because they indicated that students were reading news stories about the species in which they were most interested. However, for all semesters, the majority of students stated that they had to specifically look for articles to complete the assignments, indicating they still were not regularly reading publications in their field of interest. Of the students that responded in f13, 89.4% indicated that they searched for articles to complete the assignment. Only 10.6% found articles during their regular reading. Results were similar (P=0.3129) for s15 (84.9% went looking for articles and 15.1% found them in regular reading). In f16 fewer students found articles in their regular reading (95.5% looked for articles and 4.5% found them in regular reading, P<0.08); however, the difference was not statistically significant. Somewhat contrasting was the students' answer to the survey question, "How many magazine/newsletters/periodicals (print or electronic) related to your specie(s) of interest do you read regularly?" The mean responses in f13, s15, and f16 were 1.8, 1.5, and 2.2; with medians of 1.5, 1, and 1.5, respectively. Students self-reported that they read items related to their species of interest, but they did not use those articles for their class assignments in f13 and f16. It is possible that the sources the students read do not have any coverage of genetics topics within a one-year period. An alternative explanation is that the students encounter genetics articles, but have no interest in reading them. The discrepancy may also be due to differences in how students interpret a news

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article versus a newsletter article, even though they were not precluded from utilizing any specific source.

Summary

There was no clear and consistent pattern of improvement between pre-test and exam scores for students that participated in either writing or video assignments incorporating current news articles related to genetics. This could be a result of the timing of assignments; however, varying the due dates of assignments did not noticeably or consistently improve student performance in this area.

Both written and video assignments were rated as moderately effective in helping students to learn the concepts from class. Students rated the group video project higher in metrics related to overall perceived helpfulness in learning course content, even though these results were not consistent with numeric improvement between pre-test and exam scores. Either student perceptions of learning were inaccurate, or their level of achievement and understanding was not reflected in exam scores.

Unless constrained in topic choice, chosen subjects of both paper and video assignments were inconsistent with stated student interests, with consistently more emphasis placed on articles related to human genetics, as opposed to crops, livestock, or companion animals. Because students searched for articles specifically to complete the assignment, rather than choosing articles they encountered during regular reading, the subject often did not align with student interest. While not problematic from a course content standpoint, this result underscores what may be a deeper problem in current students-lack of engagement within their discipline.

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