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CLASSROOM EVALUATION OF AN ELEMENTARY EDUCATIONAL SWINE CURRICULUM: THERE'S A PIG IN MY CLASSROOM

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Abstract

The purpose of this study was to test an educational swine curriculum geared toward fifth grade classrooms to measure the change in students' knowledge about the pork industry, pork as a nutritious protein source, and the value of byproducts derived from pork production. Objectives of this study were to evaluate overall change in students' knowledge of the pork industry and the effect of specific demographics on the change in students' knowledge following participation in an educational swine curriculum. Effectiveness of the curriculum was measured by a pre-test/post-test survey of fifth grade students (n = 435), with classrooms divided into treatment and control groups. Findings indicated that participating in the educational swine curriculum increased the students' knowledge of the pork industry by 37.4%; demographics such as 4-H experience, farm experience, or prior experience with pigs had limited effect on knowledge gained.

Introduction

Agriculture is defined as the science, art, and business of cultivating soil, producing crops, and raising livestock (American Heritage Dictionary, 2000). From this definition, it is evident that the word "agriculture" emphasizes that the farmer of yesterday is being replaced by the entrepreneur of today who employs a combination of science, art, and business in 21st century food and fiber production (Barkley, 1995). Unlike today's general population, in 1917, one-third of the American population was located on the farm (National Research Council, 1988), and the characterization of agriculture was widely understood. Through the years, however, Americans have become increasingly suburban because of less direct contact with the agricultural industry (Birkenholz, Clark, & Pry, 1994; Law & Pepple, 1990; Sorenson, 1987). Because of massive urbanization, more than 90% of the population has been classified as 'non-farm' for over 50 years (W. K. Kellogg Foundation, 1984). Reduction in the farm population is attributed to the American farmer becoming increasingly efficient in food production practices (Balschweid, Thompson, & Cole, 1998; Barkley, 1995; DeWerff, 1989; Nordstrom et al., 1999); less than 2% of the 294 million residents of the United States remain active in production agriculture (Balschweid et al.; U. S. Census Bureau, 2004). Resulting from the shift toward urbanization, there is increasing concern about the public's literacy of the food and fiber system (W. K. Kellogg Foundation,).

As described by Blackburn (1999, p. 41), "the United States as a society can be described as ignorant about agriculture." The United States needs to strive for agricultural literacy, which "will produce informed citizens able to participate in establishing the policies that will support a competitive agricultural industry in this

country and abroad" (National Research Council, 1988, p. 2). As a result, American citizens will understand that the foundation of society and economics rests on the shoulders of the agricultural industry. Only a fraction of the United States population is active in production agriculture. This leaves more than 98% of the population not only withdrawn from the essence of our food and fiber system but virtually illiterate concerning the agricultural industry.

Though at first glance the problem appears to be an issue of adult education, the training must first begin with America's youth (Frick, Kahler, & Miller, 1991; National Research Council, 1988; W. K. Kellogg Foundation, 1984). Most children are raised far removed from the principles of production agriculture (Boleman & Burrell, 2003). The same youth will be our future leaders, governmental decision makers, and business people who will be faced with the previously discussed agricultural issues and future issues that may arise with the birth of new technologies (Boleman & Burrell). Mallory and Sommer (1986) found that many high school students "equate agriculture with farming alone, or in some cases did not even know the meaning of the word" (p. 15). As a result, there is a dire need to educate the youth of America about the principle concepts of agricultural industries (Boleman & Burrell; Law & Pepple, 1990; Meischen & Trexler, 2003; National Research Council; Nordstrom et al., 1999).

Agricultural industries must remain important if the world is to continue to sustain a growing population. With the need for increased agriculture production comes the need for agricultural literacy. DeWerff (1989) found that youth have a narrow perspective of agriculture, viewing it as farmers producing crops, raising livestock, and other basic stereotypes that accompany the farming occupation. Expanding on elementary children's lack of agricultural literacy, America's youth tend to misunderstand what food animals are or what products we derive from these animals (Trexler, Johnson, & Heinze, 2000). Youth have the idea that food simply comes from the store (Blackburn, 1999).

As noted by the National Research Council (1988), all students in kindergarten through 12th grade should receive some standard instruction about agriculture. Lessons in agriculture-related topics should be incorporated into existing courses rather than taught in separate courses. Though the need is present, many U.S. secondary schools fail to teach even basic agricultural courses, leaving a large percentage of Americans totally ignorant about an area of knowledge that is basic to their daily lives. This lack of agricultural literacy can create poor images of agriculture, skepticism of food safety and animal production methods, and a reluctance of students to enroll in agricultural curricula (Nordstrom et al., 1999). As a result, very few non-farm students elect to enroll in secondary agricultural education courses, even though they may eventually hold leadership positions which require them to become agricultural decision makers (W. K. Kellogg Foundation, 1984).

In 2001, 192 Indiana secondary schools offered agricultural education programs; only 20,905 of the state's 437,114 students ere enrolled in these classes (Indiana Department of Education, 2005; Juncker, 2005). This left more than 95% of the secondary school population void of education regarding our state's food and fiber system. American voters represent a population that can be coined agriculturally illiterate (Law & Pepple, 1990). Agricultural and environmental policies are being established by populations who are illiterate to agriculture's effects on society and the economics of our nation (Deavers, 1987).

Conceptual Framework

Research participants in this study were Indiana fifth grade students who were primarily 10 and 11 years old. As noted by Wood (1994), students who are 10 years old are beginning to concentrate on tangible products that display their competence. They work well in groups and are actively receptive learners of factual information and scientific principles. In addition, they are good listeners, voracious readers, expressive, talkative, and they like to explain. Their cognitive development

expresses their increased ability to abstract. They are able to concentrate, are becoming better at problem solving, and enjoy group activity.

In comparison, Wood (1994) found that 11-year-old students are beginning to imitate adult language, appreciate humor, and are beginning to become impulsive. Their cognitive development is beginning to desire new tasks and to enjoy scientific study. Karns and Myers-Walls (1996) found that upper elementary school-aged children (9 to 11 years old) enjoy hands-on involvement and use of props or tangible items during classroom instruction. These students were also more receptive to projects that involved making and or doing something that re-enforced classroom instruction. Students in this age group have a need to relate new concepts to previous experiences.

In order for fifth grade students to become active participants in classroom instruction, it is imperative that the presented classroom material meets a child's existing base of knowledge so that presented materials can complete the child's learning process (Wadsworth, 1989). In other words, during the acquisition of knowledge, students gather new information and build it into their existing schemata (McGrath-Speaker, 2000). In addition, a classroom setting must be interactive (Johnson, Wardlow, & Franklin, 1997; Stoecklin, 2001), containing various methods of knowledge transmission to complement various learning styles (Stoecklin) and promoting the experiential learning method to capture and meet the needs of all participating students (Mabie & Baker, 1996). Kellert (1985) found that between the fifth and eighth grade, students experienced a dramatic increase in emotional concern and affection for animals, as well as an improvement in factual and cognitive understanding of animals.

Purpose and Research Questions

The purpose of this study was to evaluate the effectiveness of an educational swine curriculum developed for fifth grade students. Teacher-ready modules were developed that included lesson plans derived from grade-appropriate Academic Standards (Indiana Department of Education, 2005), instructional materials, worksheets, visual aids, and activities to cover subject matter relating to the pork industry, pork as a nutritious protein source, and the value of byproducts derived from pork production. Research questions tested included:

1. Does participation in the "There's a Pig in my Classroom" curriculum increase the knowledge of fifth grade students about the pork industry?
2. Will demographics such as 4-H experience, farm experience or pig experience account for some of the change in scores from pre- to post-tests among participants?

The research hypothesis was: Indiana fifth grade students in the experimental group will increase their knowledge of the pork industry as demonstrated by a significant improvement in test scores following participation in the curriculum titled, "There's a Pig in My Classroom."

Treatment

"There's a Pig in My Classroom" is an educational curriculum geared toward introducing fifth grade students to various aspects of the pork industry. The curriculum contains four lessons, each approximately 1 hour in length. The lessons are designed to be used in conjunction with one another or as standalone activities. Each lesson is matched with a set of coordinating Indiana Academic Standards (Indiana Department of Education, 2005), increasing academic value.

Lesson 1 of "There's a Pig in My Classroom" begins by introducing students to common terms used in the pork industry. From there, the students embark on a virtual field trip to a modern day pork operation in northern Iowa. Here, students have the opportunity to view various aspects of the pork industry while disproving common myths. After their field trip, students learn to visually identify eight major breeds of pigs in the United States. From this point, students continue their journey by sequencing the three major life cycle phases of the pork industry: farrowing and

gestation, nursery, and growing and finishing, that eventually create a saleable product for consumers. To complete this lesson, students color each of the lower 48 states according to pork production categories. This activity effectively identifies states that are stronger in pork production and states that play a minor role in pork production while reinforcing students' knowledge and location of the lower 48 states.

Lesson 2, "Rationing My Diet" introduces the concept of a balanced diet. On their journey through this lesson, students learn the six major nutrients that should be included in a balanced diet for both people and pigs. Building on their knowledge of nutrients, students then learn exactly what ingredients are included in a pig's diet, disproving the common myth that pigs survive on slop. To further reinforce this concept, students create their own "ration" using common household snack items.

Lesson 3, "Pork on My Plate" builds on protein, an important nutrient discussed in the previous lesson. This lesson reveals the contemporary story of pork. With a worksheet and multiple visual aids, students discover that each cut of pork is derived from a specific location in the pig. Relating back to the concept of a balanced diet, students also learn which cuts of meat are healthier and which cuts should be eaten in moderation. To add the final piece to this puzzle, students visually relate cuts of pork to actual foods they consume at home, school, and in public. In discussing the handling of raw meat, students also review food safety techniques that can be used at home to clean, prepare, cook, and cool food "right."

Lesson 4, "Everything but the Oink" allows students to sequence the four major phases of the pork supply chain: production, harvesting and processing, retail and distribution, and consumption. This sequencing visually displays the concept of four segments impacting each other to produce a product, thus visualizing the chain of consumers affecting the pork producer. To further display pork production impacting daily life, students complete an activity that reveals 20 common pork byproducts that many students will use daily. Three of these byproducts: heart valves, insulin, and burn dressing, help students realize that pigs can actually save lives.

Used as a complete module, "There's a Pig in My Classroom" is designed to provide students with a foundation of knowledge concerning the pork industry, while increasing their knowledge and attitude of the impact they, as community members, have on pork production, and the impact pork production has on each of their lives.

Methodology

A quasi-experimental pre-test/post-test design was used to evaluate the nonequivalent groups in this study (McMillan & Schumacher, 2001). Elementary schools were randomly assigned to either control or experimental groups; thus, these schools served as the unit of analysis. To ensure cross talk did not occur, participant schools did not contain both control and experimental students.

Six control schools and four experimental schools participated in this study. When they were available, multiple classrooms were used to maximize student numbers and the researchers' effective teaching time. A total of 17 control classrooms and 11 experimental classrooms were used in this study. The curriculum was taught over a 4-day period, with the pretest administered on Day 1 and the posttest given to all students on Day 4. Four experimental and nine control classrooms experienced an altered schedule. This altered schedule was a 6-day schedule with the pre-test administered on Day 1, the curriculum on Day 2 through Day 5 and the post-test on Day 6 for consistency.

The sampling frame consisted of all fifth grade non-gifted or talented, public classrooms in Indiana. Simple random sampling was used in this study; each public school containing a non-gifted or talented fifth grade classroom had the same probability of being selected for this study (McMillan & Schumacher, 2001). Schools were randomly assigned to either the control or the experimental group.

Researchers used a survey-type questionnaire as a pre-test/post-test instrument. The instrument assessed knowledge gain or loss, resulting from the 4-day educational swine curriculum (experimental) or from no intervention (control). The same instrument was used for both the pre-test and the post-test. Prior to testing, survey instruments were coded by the researcher using class rosters provided by the classroom teacher. The same code was used on both the pre-test and post-test as well as on the corresponding consent and assent forms.

Field testing of the survey instrument was performed by fifth grade classrooms; however, the sampling of these classrooms was of a convenience nature. Teacher feedback aided the researcher in addressing questions that were difficult for students to comprehend. Similarly, the curriculum was field tested by the researcher with a field testing population comprised of fifth grader students. This curriculum was reviewed by numerous pork industry officials to ensure the accuracy of pork facts contained in the curriculum. Elementary school teachers reviewed the curriculum for grade appropriateness and feasibility.

Data for each student included the completed set of both a pre-test and a post-test. If the data set was incomplete, that student was eliminated from the study. Data were analyzed using the Statistical Package for Social Sciences (2003). Descriptive statistics were gathered for demographics and correct and incorrect responses. Chi-square analysis was used to test significance between correct and incorrect responses of each question because data were both non-continuous and nominal. In addition, paired *t*-tests were constructed for each question. A multivariate analysis of covariance (MANCOVA) was used to test students' pre-test scores (covariate) against post-test scores (the dependent variable), allowing the group to serve as the fixed factor; a multivariate analysis of variance (MANOVA) was used to test questioned demographics for significant differences among experimental students.

The change in knowledge from pre-test to post-test between control and experimental groups was tested for statistical significance using the *t*-test portion of the general linear models procedure of SAS (v. 8.2). The formula for the *t*-test is a ratio. The top part of the ratio is the difference between the two means or averages. The bottom part is a measure of the variability or dispersion of the scores. The *t*-test assesses whether means of two groups are statistically different from each other. The change in knowledge from pre-test to post-test of three subgroups (with or without 4-H, farm, and pig experience) within the experimental group were tested for statistical significance using the *t*-test as well.

Results

Two hundred thirteen students participated in the control group and 222 students were in the experimental group for an overall population of 435 fifth grade students. Students in the control group received no treatment between the pre-test and the post-test; students in the experimental group received 4 hours of special educational curricular instruction between the pre-test and post-test.

Demographics

The student population consisted of mostly 10 and 11 year olds that were primarily Caucasian (Table 1). Overall percentages of students with a 4-H background, farm experience, and experience with pigs were similar to percentages present among control and experimental students.

Table 1
Frequency Distribution of the Demographic Variables of the Sampling Population

	Experimental (n = 222)		Control (n = 213)	
Variable	*f*	%	*f*	%
Age				
< 10	7	3.2	0	0.0
10	91	41.0	99	46.5
11	108	48.6	98	46.0
12	16	7.2	15	7.0
> 12	0	0.0	1	0.5
4-H background				
Yes	64	28.8	37	17.4
No	158	71.2	176	82.6
Farm experience				
Yes	109	49.1	99	46.5
No	113	50.9	114	53.5
Pig experience				
Yes	26	11.7	24	11.3
No	196	88.3	189	88.7

The mean knowledge section pre-test score for the experimental group was 51.2%, and the control group's mean was 52.2% (Table 2). On completion of the post-test, the experimental group's mean score was 88.6%, with scores ranging from 33.3% to 100%. The control group's mean score averaged 52.2% on the post-test, with scores ranging from 11.1% to 88.9%.

Results of the Chi-square test shown in Table 2 illustrate a significant difference between the experimental and control groups' ability to correctly answer each question on the post-test with the exception of Question 9. The lack of significance could be due to the question itself, which asks a common hygiene practice taught in many elementary classrooms. Additionally, this question had a relatively high percentage of correct answers (86% and 88%, for the experimental and control groups, respectively) on the pre-test, which may make measurable improvement more difficult to detect.

Table 2
Comparison of Experimental and Control Group Means By Question

Question	Test	*n*	Experimental group	*n*	Control group	Chi-square value	*p*-value
7. Pigs are raised mostly in the _____ part of the United States.	Pre	222	37.4	213	40.8	0.546	0.460
	Post	222	82.4	213	41.8	76.657	*
8. On average, a mother pig can have how many baby pigs at one time?	Pre	222	31.1	213	40.4	4.094	*
	Post	222	73.0	213	40.4	47.130	*
9. The best way to wash our hands is with:	Pre	222	85.6	213	88.3	0.684	0.408
	Post	222	92.3	213	88.7	1.659	0.198
10. Which of the following IS a breed of pigs?	Pre	222	14.4	213	11.7	0.684	0.408
	Post	222	86.5	213	8.9	261.841	*
11. Pigs eat which of the following in a balanced diet?	Pre	222	21.6	213	32.4	6.416	*
	Post	222	86.9	213	27.2	158.774	*
12. The choices people make when shopping affect pig production.	Pre	222	73.0	213	65.7	2.688	0.101
	Post	222	86.5	213	64.8	27.948	*
13. Pork is the meat product from which animal?	Pre	222	94.6	213	91.1	2.029	0.154
	Post	222	100.0	213	93.0	16.192	*
14. Which of the following products contain ingredients from a pig?	Pre	222	24.3	213	20.2	1.074	0.300
	Post	222	92.8	213	25.4	205.615	*
15. Which of the following are the correct names for pigs? (A mother pig, a father pig, and a young girl pig.)	Pre	222	78.8	213	79.3	0.017	0.895
	Post	222	97.3	213	79.8	33.249	*
Pre-Test		222	51.2	213	52.2		
Post-Test		222	88.6	213	52.2		*

* $p \leq 0.05$.

Effectiveness of this curriculum was assessed by measuring the change in the percentage of correct answers from the pre-test to the post-test. On the pre-test, students in the experimental group had significantly fewer correct answers on Questions 8 and 11 compared with the control group. On the post-test (Figure 1), the experimental group demonstrated a significant improvement in the percentage of correct answers on eight of the nine questions. Students in the experimental group had significantly more correct answers on Questions 7, 8, 10, 11, 12, 13, 14, and 15 than the control students. The only question that students in the experimental group did not have more correct answers than control students was question 9, "The best way to wash our hands is with…" Furthermore, the experimental group had more improvement in the test scores from the pre-test to the post-test than the control group. Each question within the experimental group demonstrated a positive increase of knowledge from the pre-test to the post-test. On eight of the nine knowledge based questions, the experimental group demonstrated a greater improvement in scores over time as compared to the control group. On the other hand, the control group's results displayed a low, positive percentage of knowledge gain on six questions and exhibited a low decrease in knowledge from the pre-test to the post-test on three questions.

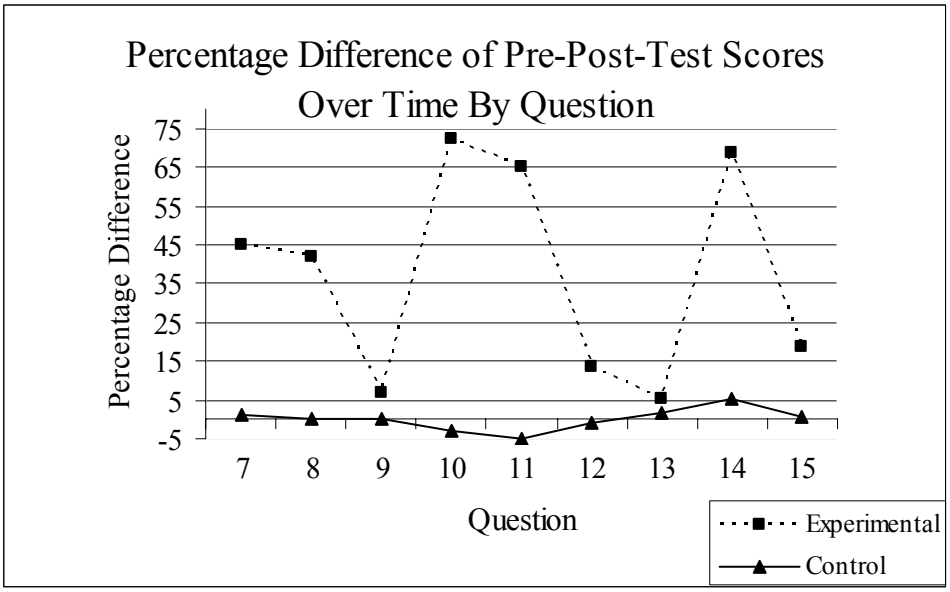

Figure 1. Percentage change from pre- to post-test scores over time by question.

The demographics of 4-H background, farm experience, and experience with pigs were analyzed for statistical differences among students receiving the swine curriculum instruction. Overall, demographic subcategories did not affect the overall mean scores of the pre-test or post-test of control and experimental groups, although particular questions were affected. Previous 4-H experience was shown to affect Question 12, "The choices people make when shopping affect pig production." Data revealed that within the experimental group, students with previous 4-H experience showed an increase of 29.7% from pre-test to post-test on question 12; students without 4-H experience only showed a 7% increase from pre-test to post-test. Previous 4-H experience did not affect the outcome on any of the questions answered by the control group.

Previous farm experience affected only one of the nine test questions for the experimental group, Question 10, "Which of the following IS a breed of pigs?" When looking at differences within the control

group, only Question 12 displayed significance between pre-tests and post-tests due to previous farm experience.

The experimental group displayed significant differences on two of the nine pre-test questions due to previous pig experience. Question 10, "Which of the following IS a breed of pigs?" displayed a significant difference on the pre-test, with the higher score coming from the group with previous pig experience. On the other hand, Question 13, "Pork is the meat product from which animal?" displayed a significant difference, with the higher score belonging to the students with no previous pig experience. In a summary of previous experience analysis, the following demographics influenced certain test questions:

4-H Experience
- Question 12 post-test, experimental group

No Previous 4-H Experience
- Question 20 pre-test, experimental group
- Question 25 post-test, control group

Farm Experience
- Question 10 pre-test, experimental group
- Question 12 post-test, control group
- Question 22 post-test, control group
- Question 23 post-test, control group

No Previous Farm Experience
- Question 24 pre-test, experimental group
- Question 24 post-test, experimental group

Pig Experience
- Question 10 pre-test, experimental group
- Question 10 post-test, control group
- Question 11 post-test, control group

No Previous Pig Experience
- Question 13 pre-test, experimental group

Conclusions, Implications, and Recommendations

In summary, the students who participated in the "There's a Pig in my Classroom" curriculum demonstrated a 37.4% increase in knowledge about the pork industry; they improved their test scores from an average of 51.2% on the pre-test to 88.6% on the post-test. The mean post-test score for the control group remained at 52.2%. In agreement with Boleman and Burell (2003), Brown and Stewart (1993), Herren and Oakley (1995), and Rusk and Machtmes (2003), an agricultural curriculum can increase the post-test scores of experimental students.

Future studies should look more deeply into the concept of knowledge retention. This study employed a pre-test followed by a post-test a few days later. It would be worthwhile to administer an additional post-test a few months after the original post-test. The goal of an educational curriculum is to increase the knowledge of the recipients. Long-term increases in knowledge have the potential for greater impact than short-term gains in knowledge or attitudinal changes.

Also, more multimedia educational activities should be developed for use with the current curriculum. Additional instruction in the form of a computer-based activity would help expand the curriculum. Computers are an integral part of daily life, with instruction starting at a young age. A nice complement to this curriculum would be an interactive CD that would allow students to look more deeply into the various phases of swine production, methods of housing, and/or layouts of swine operations. Because of classroom constraints, however, this type of instruction should be complementary and not the main source of education.

There is a constant need for agricultural curricula that targets all grade levels. This curriculum targeted fifth grade students because of their emotional concerns and affection for animals as well as their improved factual and cognitive understanding of animals (Kellert, 1985). This belief was also supported by Townsend (1990), who found that pre-secondary agricultural education programs can also

build positive attitudes toward agriculture in its students, allowing them to develop into positive and informed leaders. Based on the positive results of this study, the researchers recommend that the curriculum "There's a Pig in My Classroom" be expanded and developed for additional grade levels, providing constant reinforcement of agricultural concepts and principles.

The second research question was, "Will demographics such as 4-H experience, farm experience or pig experience account for some of the change in scores from pre- to post-tests among participants?" After analyzing results for possible effects from previous 4-H experience, results showed a greater increase in the number of correct answers to Question 12, "The choices people make when shopping affect pig production," from pre- to post-test among the experimental group with 4-H experience than among the experimental group without previous 4-H experience, On this question, the experimental group with previous 4-H experience showed a 29.7 point increase in score, whereas the experimental group with no 4-H experience only increased their score by 7.0 points. This is in comparison with "no significant control group difference" within the knowledge section due to previous 4-H experience. The researcher concluded that previous 4-H experience did not have a significant effect on this study's results when analyzed as a whole.

Results of this study are concurrent with the findings of Mabie and Baker (1996), who found that fifth grade students learned from experiential instruction about agriculture. Specifically, "There's a Pig in My Classroom" was effective at increasing students' knowledge of the pork industry, and thus should be made available to teachers across the country through the National Pork Board Web site or on DVDs. An additional means of distribution could include promotion of this curriculum through channels of the Cooperative Extension Service.

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