

# ***THE EXTENT OF INSTRUCTOR PARTICIPATION IN AN ONLINE COMPUTER SCIENCE COURSE How Much is Enough?***

**Abdurrahman Arslanyilmaz and John Sullins**

*Youngstown State University*

This study compares the discussion participation and performance of 7 undergraduate students enrolled in an e-commerce programming course during the spring semester of 2010 to that of 13 students enrolled in the same course during fall of that year. In the former course, the instructor participated in the required discussion only at the very end of the discussion period; in the latter, the instructor was an active participant at least once during the middle and once before the end of the discussion period. Students' discussion participation level was measured by their message-posting rate, and student performance was measured in terms of their scores on assignments. Results showed that the frequency and promptness of instructor participation have no effect on student participation or performance in online classes.

Online courses provide several advantages and benefits over traditional instruction within the classroom environment. Not only do they reduce the need for an active teacher, they also speed up student access to information. Students receive information that can be updated easily and quickly, they can review or download supplementary course materials quickly, access the online course at their own convenience and from any location with an Internet connection, and communicate with peers and tutors based on their own personal schedule

(Waugh & Chan, 2007). Further, online instruction provides the ability to create an individualized learning environment, enables representation of concepts through multimedia (audio, video, animation, and graphics), gives opportunities for handicapped learners, has low costs of development and management, and can create a multicultural learning environment.

Online discussions are often a key component of these courses. A discussion forum provides a virtual space for the exchange of ideas

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• **Abdurrahman Arslanyilmaz**, Assistant Professor, Computer Science & Information Systems, Meshel Hall 324, Youngstown State University, Youngstown, OH 44555. Telephone: (330) 941-1787. E-mail: aarslanyilmaz@ysu.edu

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and debate among students, as well as between teachers and students (Cheng, Paré, Collimor, & Joordens, 2011). In addition, online discussions:

- allow students to actively participate in the discussions without feeling inhibited by the presence of other students;
- allow the degree of participation by an individual student to be independent of the number of other students in the class;
- do not require all students to participate at the same time, allowing the flexibility of choosing their own times;
- enable extensive interactions outside the classroom environment;
- allow students to reflect more deeply on issues (Ellis, Calvo, Levy, & Tan, 2004);
- provide an equal opportunity platform for participation (Ho & Swan, 2007); and
- have a positive effect on students' course grades (Cheng et al., 2011; Ho & Swan, 2007; Patel & Aghayere, 2006; Picciano, 2002; Taradi & Taradi, 2004; Wang, 2004).

The instructor plays an active part in online discussion as a facilitator and teacher. According to Mazzolini and Maddison (2002, p. 239), the degree to which instructors participate in discussion forums affects the quality of online courses. It is important for the instructor to make thoughtful comments on student messages to stimulate further discussion, and to motivate students to go deeper and further with the materials than they might in a face-to-face classroom (Mazzolini & Maddison, 2002).

However, the research regarding the effects of instructor participation on student participation in online discussion is not conclusive. Some research has concluded that instructor participation makes a positive difference in the level of voluntary student discussion (Thompson & Savenye, 2007), increases students' participation in the discussion (Wise, Hamman, & Thorson, 2006), adds more credibility to the discussion (McIsaac, Blocher, Mahes, & Vrasidas, 1999), and makes students feel comfortable about their discussions and gives them

direction during discussions (Zhang, Gao, Ring, & Zhang, 2007). Others, however, have concluded that frequent instructor participation has a negative impact on student participation, does not lead to more student postings, and shortens the length of the discussion threads by students (Mazzolini & Maddison, 2002), decreases the number of postings by students (Mazzolini & Maddison, 2007), and does not lead to more interaction among the students (An, Shin, & Lim, 2009). Furthermore, to the best of the authors' knowledge, there has been no research with regard to the effect of the frequency and promptness of an instructor's participation on students' course performance in online courses.

The purpose of this study, therefore, is to examine the effect that frequency and promptness of instructor participation has on student participation in online discussions and on student performance in online classes. Specifically, the purpose is to determine answers to the following questions:

Do students post and reply to more messages when the instructor participates more frequently and promptly in online discussions?

Do students perform better in online courses when the instructor's responses to students' messages are more frequent and prompt?

## **METHOD**

### ***Participants***

The participants were undergraduate students voluntarily enrolled in an e-commerce programming course offered in the spring and fall semesters of 2010 through the computer science and information systems department at a university in the Midwestern United States. There were seven students enrolled in the spring of 2010, and 13 students in fall. Students were in either their third or fourth years of undergraduate education in the computer science and information systems department, and were generally articulate, enthusiastic adults (average age 19), but most lacked any

prior experience of online learning. They were required to take programming and problem solving as a prerequisite before they could enroll into the online course. No extra credit or grade was awarded to students for participation in this study.

### ***E-commerce Programming Course Structure, Goals, and Assignments***

E-commerce programming is a fully online course offered at the 3000 level (junior year) for students pursuing an information technology degree. Overall, the course objectives were to code PHP to send data to and to retrieve data from the Web browser; to use SQL syntax to store, modify, sort, delete, and retrieve data from MySQL database; to create, modify, and use relational MySQL databases; to build a login system using cookies and sessions; and to validate forms with PHP and JavaScript.

The course was divided into 14 units to be completed over 16 weeks. Students completed 14 assignments (1 per unit) and a semester-long final project. These assignments helped students develop their skills in PHP, SQL, MySQL, and HTML programming, and were compatible with the stimulus questions posted in the discussions. The specifications of these assignments were announced at the beginning of each discussion period on Monday (see Appendix A for a sample assignment). At the end of the semester, the assignments comprised a semester-long final project.

Approximately five videos were recorded and integrated into each of the 14 units, the purpose of which was to explain the unit topics using practical examples similar to the problems that the students were assigned. The videos ranged between 20 minutes to an hour. In each video, an expert solved a case like that assigned to the students, modeling his cognitive processes as he engaged in problem solving, thinking out loud as he solved the problem, explaining his reasoning process, asking questions, and answering those questions to confirm his understanding.

### ***Discussion Forum***

Online discussions were a required component for 10 of the 14 units in this course, and all of the students were expected to actively participate in them. Asynchronous online discussion forums for the 10 units were set up as a collaborative tool and a central part of the teaching strategy. The forums were accessible only by students enrolled in the course and the instructor. The anonymous post function was disabled in order to keep students accountable. Each unit lasted 1 week (Monday through Sunday), and unit discussions were open from the first day of the unit till the last. Students were expected to be in the discussion forums for a minimum of 2 days within the week of each unit, and were expected to participate often. The instructor monitored all online discussions. Students were encouraged to read the assigned chapters and watch the videos prepared for every unit before participating in the discussions.

Discussions were centered on approximately 20 stimulus questions that addressed key issues in each unit. Students contributed to the discussions by sending their original responses to at least one of the stimulus questions by the Thursday of each unit. The original responses were expected to address the stimulus questions directly. After everyone posted their responses, an interactive discussion was expected to develop in which students responded to each other's ideas. Students were expected to read all the postings contributed by their classmates. Every student was required to post a follow-up question as a response to at least one of the original messages from their classmates by the end of the discussion periods on Sunday. The discussion messages, original responses, and follow-up responses were each required to be substantive, according to the following definitions:

- Messages were to be at least one paragraph long, and were required to have one or both of the following characteristics:

- They demonstrated what students learned from the units, possibly including one or more examples related to their answer so as to make it easier to understand by other classmates participating in the discussion.
- They built on messages of classmates and enriched the discussion. Elaborating on the nuances involved in an issue, or providing a further example to illustrate another classmate's point were examples of ways to build substantively on their classmates' contributions.
- Posts that simply agreed with classmates, posed a question, or added minor points were not counted as substantive.

### ***Treatment Conditions***

The treatment conditions were composed of the discussions with delayed and less frequent instructor participation and the discussions with prompt and more frequent instructor participation. Delayed and less frequent instructor participation was done in spring 2010 (the control group), and students in this class are labeled as the lesser instructor participation group (LIP). Prompt and more frequent instructor participation was done in fall 2010 (the experimental group), and students in this class are labeled as the greater instructor participation group (GIP).

In the LIP class, the instructor did not actively participate in the online discussion, but instead waited until the end of the discussion period to post his or her responses to the students' postings. In his reply, he would explain any misunderstandings, confirm the correct responses, correct the incorrect responses, and support the responses by providing some practical examples. Ideally, the instructor would not have participated at all in the LIP group in order to maximize the differences between the two; however, the goals of this study were necessarily balanced with the goals of the course, which was to insure that students were ultimately exposed to and understood the correct answers to the questions. In

any case, the final participation of the instructor at the end of the discussion was a separate process that did not affect the flow of the discussion beforehand, in which students were required to produce substantive posts without interaction with the instructor. An example of this process is given in Excerpt 1 below.

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#### **Excerpt 1**

Message no. 379[Branch from no. 327]

Posted by CR on Wednesday, January 20, 2010 5:59pm

Subject: 8-If the user submits a form without any value typed in a text field, what value will be sent to the handling document for the text field?

Nothing will be passed. Instead the value will be Null, 0, or false. So to check to see if nothing was passed you can use the empty() function which will return a boolean value telling you if a value is null or not.

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Message no. 400[Branch from no. 379]

Posted by JC on Sunday, January 24, 2010 7:11pm

Subject: Re: 8-If the user submits a form without any value typed in a text field, what value will be sent to the handling document for the text field?

It is still good practice to use both to be able to expand onto your site later down the road and use CSS.

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Message no. 403[Branch from no. 379]

Posted by RH on Sunday, January 24, 2010 11:55pm

Subject: Re: 8-If the user submits a form without any value typed in a text field, what value will be sent to the handling document for the text field?

At first I couldn't reason why I would need to know if the value of the field was null, but after giving a few moments of thought, there

are times when a field should have a value and not allowed to accept a null value. Since this isn't my strong point in IT, I try to keep things simple when it comes to html and programming.

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Message no. 410[Branch from no. 379]

Posted by the Instructor on Wednesday, January 27, 2010 7:55pm

Subject: Re: 8-If the user submits a form without any value typed in a text field, what value will be sent to the handling document for the text field?

Actually, with the input fields and text areas, empty text will be passed, which is different than null. Therefore, you should evaluate the value from an input field or text area using empty() function instead of isset() function. On the other hand, pull-down menus, radio buttons, and check boxes will pass null value, which could be evaluated using isset() function.

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In the GIP class, the instructor responded to students' original and follow-up postings as he deemed necessary, without waiting for a response from a classmate. When responding to a post, if the post successfully answered the stimulus question, he confirmed the original post and raised another related issue so as to enrich the discussion and give extra information. If the post did not answer the stimulus question completely or correctly, he played devil's advocate and asked additional questions that students would know based on their previous knowledge, and would cause them to understand the incorrectness of the original response. At the end of the discussion period, if the students were not able to find the correct answers to the stimulus questions, the instructor would answer the stimulus questions and give an explanation with some examples. An example of this process is given in Excerpt 2 below.

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Excerpt 2

Thread: Question 2

Post: RE: Question 2

Author: MS

Posted Date: September 15, 2010 11:56 PM

The method attribute is used to specify how the data of the form is sent to the handling document. The two options get & post refer to the HTTP method to be used.

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Thread: Question 2

Post: RE: Question 2

Author: The Instructor

Posted Date: September 13, 2010 6:14 AM

Actually, there is another one, "\$\_REQUEST," which checks both \$\_GET and \$\_POST for their values.

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Author: Kenneth Corbett

Date: Friday, September 10, 2010 10:44:26 PM EDT

Subject: RE: Question 2

The attribute used to specify how the data from the form is sent is the "method" attribute. It has two options, get and post.

(Post is Read)

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Thread: Question 2

Post: RE: Question 2

Author: The Instructor

Posted Date: September 13, 2010 6:18 AM

There is one more thing to add to what CP said in his posting. The amount of information to be sent with GET method is too limited as compared to the amount of information to be sent with POST method.

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Thread: Question 2

Post: RE: Question 2

Author: GM

Posted Date: September 12, 2010 9:51 PM

I like this answer. It gets straight to the point and there isn't really anything I would add to this. The only thing that could be added to this answer is what the "post" and "get" method does. However, I feel that the extra information is unnecessary since that isn't what the question asked. Good job on your answer.

Thread: Question 2

Post: RE: Question 2

Author: CP

Posted Date: September 12, 2010 9:00 PM

I am not sure what the differences are, but I know the GET method can show private information in the address bar such as email, passwords etc. that you have typed into the form. The post method I believe sends the private data through the body, leaving no sensitive data in the bar.

Thread: Question 2

Post: RE: Question 2

Author: The Instructor

Posted Date: September 11, 2010 2:13 PM

What are the differences between the GET and POST methods?

Thread: Question 2

Post: RE: Question 2

Author: KC

Posted Date: September 10, 2010 10:44 PM

The attribute used to specify how the data from the form is sent is the "method" attribute. It has two options, get and post.

Thread: Question 2

Post: Question 2

Author: The Instructor

Posted Date: August 10, 2010 2:45 PM

Which attribute of the form tag is used to specify how the data of the form is sent to the handling document?

Table 1 compares the mean response time and percentage of instructor participation in the LIP group to the mean response time and percentage of instructor participation in the GIP group. The percentage was measured by dividing the number of substantive messages posted by the instructor into the total number of substantive messages posted by both the instructor and the students, and multiplying the result by 100 (Mazzolini & Maddison, 2002). The mean response time was measured by dividing the total number of hours that elapsed between the student postings and the instructor's responses by the number of messages that received the responses. As seen in Table 1, the instructor participation was 37% in the GIP (experimental) group, as opposed to 17% instructor participation rate in the LIP (control) group. Also, the instructor responded to the students' postings in an average of 32 hours in GIP group as compared to 143 hours mean response time in the LIP group. Hence, the percentage of instructor participation was 2.17

TABLE 1  
Comparison of the Instructor Participation in GIP and LIP Groups

| Group | TIP | TP  | PIP | MRT    |
|-------|-----|-----|-----|--------|
| LIP   | 26  | 153 | 17  | 143hrs |
| GIP   | 130 | 350 | 37  | 32hrs  |

Note: TIP: Total number of instructor postings. TP: Total number of postings. PIP: The percentage of instructor postings. MRT: The mean response time in hours.

times more and the mean response time 4.46 times less in the GIP class than in the LIP.

### DATA COLLECTION

The rate of student participation in online discussions and the student performance in the online course were the two dependent variables. The messages posted by students and instructors in the two groups and students' scores on the 10 required assignments were collected. Therefore, the data set for this research study included the total number of instructor postings, the total number of student postings, the total number of postings, the total number of discussion threads, and the scores of the students on the required assignments over 10 weeks.

### DATA ANALYSIS

Student participation level in discussion (designated as the message posting rate by students) was measured by dividing the number of substantive messages that the students posted (either as original posts or as replies to other posts) in the discussion forums by the total number of students (Cheng et al., 2011; Mazzolini & Maddison, 2002; Thompson & Savenye, 2007). The average discussion thread length was measured by dividing the total number of substantive student postings by the total number of discussion threads (Mazzolini & Maddison, 2002). Average student perfor-

mance (ASP) was measured as the total scores of the students on the required assignments over the 10 assignments divided by the number of students (Cheng et al., 2011; Thompson & Savenye, 2007).

To analyze the effect of the frequency and promptness of instructor contribution on the rate of student participation and student performance, this study required a MANOVA because the experiment affected each of the dependent variables separately and in combination with each other. The level of significance (alpha) was set at .05. Hotelling T2 was used to determine overall multivariate significance of dependent variables on the groups.

### RESULTS AND DISCUSSION

The overall aim of this study was to investigate how the frequency and promptness of instructor participation affected student participation and student performance in the online courses. The dependent variable was the posting rate by students (PRS) and average student performance (ASP) on the 10 required assignments. The independent variable was the two groups, the LIP and the GIP groups.

Table 2 shows that students in the GIP group posted 1.74 times more messages to the discussion than students in the LIP group. However, the posting rate by students in the LIP group was about 1.05 times more than the posting rate by students in the GIP group. Therefore, even though the total number of messages posted by all students in GIP was

TABLE 2  
Total Number of Student Postings, Postings, Number of Students,  
and Discussion Threads; Average Student Performance and Discussion Thread Length,  
and Posting Rate by Students Across Groups

| Group | TSP | TP  | TNS | PRS | TDT | ADTL | ASP |
|-------|-----|-----|-----|-----|-----|------|-----|
| LIP   | 127 | 153 | 7   | 18  | 62  | 2.05 | 77  |
| GIP   | 221 | 350 | 13  | 17  | 104 | 2.13 | 67  |

*Note:* TSP: Total number of student posting. TP: Total number of posting. TNS: Total number of students. PRS: Posting rate by students. TDT: Total number of discussion threads. ADTL: Average discussion thread length. ASP: Average student performance.

greater, the number of postings by each student was slightly greater in the LIP group than the GIP group.

The table also shows that the total number of discussion threads was 1.67 times greater in the GIP group than in the LIP group. However, average length of discussion threads was only 1.03 times greater in the former than the latter. This means that the depth of discussions in the GIP class was only slightly greater than that in the LIP.

Finally, Table 2 illustrates that the average score of the students in the GIP group was 67 out of 100 while the LIP group averaged 77. Thus, the LIP students performed about 1.15 times better than the GIP students.

A multivariate analysis of variance was conducted to assess if there were significant differences between the two groups in the posting rate by students and the average student performance. MANOVA output did not show a significant multivariate main effect for Group at .05 significance level, with Hotelling's  $T = .1$ ,  $F = .85$ ,  $p = .444$  (see Table 3). This result suggests that students in the GIP group did not significantly differ from students in the LIP group. In addition, a SSCP matrix between groups explained only a small proportion of the variance (.091).

Examination of the coefficients for the linear combinations indicated that posting rate by students ( $F(1, 18) = .156$ , Partial  $\eta^2 = .009$ ,  $p = .697$ ) and average student performance ( $F(1, 18) = 1.78$ , Partial  $\eta^2 = .09$ ,  $p = .19$ ) in the groups were not significantly different. Based on partial  $\eta^2$ , the average student performance effect appears stronger than the posting rate by student effect. Univariate ANOVAs indicated

that posting rate by students ( $F(1, 18) = .156$ ,  $p = .697$ ) and student performance ( $F(1, 18) = 1.78$ ,  $p = .19$ ) in the LIP group were not significantly different than those in the GIP group.

These results suggest that students' participation in the online discussion was not significantly different between the two groups in terms of the posting rates by the students. This refutes the expectation that students in the GIP group would participate more often in the online discussion because they were aware of the presence of the instructor.

While the posting rate per student was almost equal in both groups, students in the GIP section posted 1.74 times more substantive original messages and follow-up messages in online discussions than students in the LIP group. This means that students in GIP section were not as active as those in the LIP. This is particularly interesting since the LIP group had only seven students while the GIP group had 13. Empirical research to date has indicated that as group size increased, the proportion of learner-learner interaction increased as well (Caspi, Gorsky, & Chajut, 2003), but this result was not borne out in this study. There are three possible explanations for this:

1. Since the instructor in GIP group responded to student messages quickly, the instructor's definitive response may have discouraged further participation by students in the GIP group despite the greater number of students posting.
2. The structured nature of the discussion participation and the evolution of discussion around stimulus questions posed by

TABLE 3  
Comparison of Mean Number of PRS and ASP Across Groups

| Groups        | Value | F   | P     | Observed power | Partial $\eta^2$ |
|---------------|-------|-----|-------|----------------|------------------|
| Hotelling's T | .1    | .85 | .444* | .172           | .091             |

Note: PRS = Posting rate by students. SP = Student performance. \*  $p < .05$ .

- the instructor may have resulted in fewer postings by the larger group size. Since most of the questions posed had a “correct” answer, once most students agreed that answer had been posted then no more messages needed to be posted regardless of the number of students available to post. That is, the discussion forum with more participants (GIP) may have failed to produce enough new material to justify continued postings to the online discussions.
3. The postings in the online discussion may have caused cognitive overload due to the amount of work required for a posting to be defined as “substantive.” The discussions in this study were led by stimulus questions and the postings required students to solve problems, exhibit reasoning skills, and illustrate certain subject matters that may have created information overload. Jones (2000) reported that the upper boundary for the amount of participation is determined by cognitive factors. The students might have felt cognitively overloaded, and might have chosen to end participation at a certain level.

While the effects of instructor participation in online discussion on students’ performance were not statistically significantly different between the groups, it must be noted that the LIP group performed 1.15 times better than the GIP group. The slight but not statistically significant difference suggests that when the instructor was less active in online discussions, students performed better in the course. This could be because the instructor was able to invest more time in helping the students when he was less active in participating in online discussions. This may also be attributed to the variation in the number of students between the two groups; literature suggested that the smaller the learning group, the shorter the distance between the instructor and learners (Chen & Willits, 1998), the more satisfied the learners are with the courses and more apt to exceed their previous academic performances

(Biner, Welsh, Barone, Summers, & Dean, 1997), and to score higher on exams (Sugrue, Rietz, & Hansen, 1999). Therefore, it is possible that students in the LIP group were able to get more attention than students in GIP because of the smaller number of students in that group.

## CONCLUSIONS

These results provide evidence that the degree to which the instructor participates in online discussion does not affect the amount of student participation in online discussions. Students’ performances in the two groups, LIP and GIP, were not statistically significantly different. This means that the instructor’s active participation in online discussions does not affect the students’ performances on assignments, and that the frequency and promptness of instructor participation in online discussion do not have any significant effect on student participation and student performance in online classes. These results do not support findings that instructor participation makes a positive difference in the level of student participation (Thompson & Savenye, 2007; Wise et al., 2006), nor do they support findings that instructor participation had a negative impact on student participation in online discussions (An et al., 2009; Mazzolini & Maddison, 2002, 2007).

However, it must be noted that there were more students in the GIP group (13) than in the LIP group (7), which might have affected the result of this study. For example, even though students in GIP group posted 1.67 times more messages in online discussions than the students in LIP group, the LIP group had a higher posting rate (1.05). It is, therefore, logical to conclude that students in GIP were not as active as the students in LIP group. We conclude that there may be three reasons for this: (1) students in GIP could have been discouraged by the active participation of the instructor, (2) the discussion could have become saturated after a certain level where students

failed to produce enough new material to justify their continued postings to the online discussions, or (3) students in GIP could have felt overloaded by the information in the discussion and therefore could have given up posting more messages after a certain number of messages.

### ***APPENDIX A: THE SPECIFICATIONS OF THE REQUIRED ASSIGNMENT FOR UNIT 3***

In this assignment, you will create a PHP file to handle the form that you developed in the second assignment. After the user submits the form, the following information should be displayed in the web browser,

1. Selected values for pull-down menu(s) and radio button(s);
2. Typed values for text input field(s) and text area(s);
3. Checked values for the checkboxes; and
4. Error messages for any form element which is submitted without a value.

Create a folder within the “e\_commerce” folder you created in the first unit, and name this folder as “Assignment\_3,” and upload this file into the “Assignment\_3” folder.

### ***APPENDIX B: 21 STIMULUS QUESTIONS POSTED IN UNIT 3***

1. How do we access the first name data submitted using a text field called “first\_name” within an HTML form where GET method is used?
2. What are some common features shared by all super global variables?
3. If the user does not type in anything within a text field, what value will be received through the \$\_POST super global variable for that text field form element?

4. If the user does select anything for a pull down menu option, what value will be received through the \$\_POST super global array for that form element?
5. If the user does check anything for a checkbox/radio button before submitting the html form, what value will be received through the \$\_POST superglobal array for that form element within the handling document?
6. In the handling document before processing the data submitted by the user, why do you need to escape the single/double quotation marks that may exist within the input?
7. In which cases, you do not need to escape them?
8. How do you escape the single/double quotation marks that may exist within the input submitted by the user?
9. After making sure that single/double quotation marks are escaped and stored in the database, when you need to display them back on the browser by retrieving them from the database, what do you need to do before you display them on the web browser?
10. When do you NOT need to use the curly braces {} after an if, else, or elseif statement?
11. Give us an example using NOT (!) operator within a conditional
12. If you have an if ... elseif ... else construct, when is the else conditional statement executed?
13. What is the function used to check whether the Magic Quotes settings at the server is enabled or not?
14. In what situations ini\_get() function is used?
15. Give us an example where if-elseif-else conditional statement is used?
16. Why do you need to put the else conditional at the end of an if-elseif-else conditional block? Give us an example
17. What are the two functions that can be used to test whether a form element was

- submitted without a value or not? And what is the difference between them?
18. What type of form element can be tested using empty() function? Give us an example usage?
  19. What type of form element can be tested using isset() function? Give us an example usage?
  20. What is the function that we need to use to turn the display errors setting at the server on, and to set the error reporting level? Give us an example
  21. What attribute is used to address the name and the location of the file to handle the HTML form?

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