Taking Professional Certification Exams: The Correlation Between Exam Preparation Techniques and Strategies and Exam Results

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Professional certification is viewed by the public as credible evidence of skills and knowledge within a field of professional practice. Professional certifications enhance the skills required by the profession and provide recognition by peers as competent within the profession. In this paper, we investigate the factors that could improve the performance of certification exam taker. We explore the correlations between various techniques and strategies used to prepare for professional certification exams and the corresponding exam results. This study examined several control variables that have both positive and negative correlations with the exam outcome across several professional certification exams. An understanding of the research findings will allow for improved certification exam performance and provide direction for prospective candidates who would like to be certified to enhance their skills.

Keywords: certification exam teaching pedagogy, exam preparation, testing techniques, exam study tips, passing certification exams

INTRODUCTION

Almost every industry has some level of professional certification. Such certifications can advance the profession and aid employers in evaluating the knowledge and skillsets of potential employment candidates, they may also improve employee discipline competence and job performance. Professional certifications can be found in a host of industries such as accounting (Certified Management Accountant – CMA), finance (Certified Financial Analyst - CFA), project management (Project Management Professional - PMP), agile scrum (Professional Scrum master – PSM), governance risk and compliance (Control Objectives for Information and Related Technologies - COBIT 2019), information technology service management (Information Technology Infrastructure Library - ITIL), supply chain management (Certified Supply Chain Professional - CSCP), and quality (Lean Six Sigma Green Belt – LSSGB), etc.

This listing represents only a few from a wide range of professional certification that requires voluntary or compulsory certifications which have fueled explosive growth in the professional certification market.

It is estimated that over three million Americans between the ages of twenty-five and sixty-four hold an industry-related certification as their highest postsecondary credential (Lumina Foundation Strategic Plan 2017-2020). This study compared the exam preparation techniques and strategies to its corresponding exam results across several industry certification exams. Specifically, an analysis of control variables is examined in an attempt to identify specific correlations that have both positive and negative impact on exam results. Such understanding may provide tangential teaching pedagogy impact indicators that positively contribute to exam success and workplace advancement.

LITERATURE REVIEW

The available literature on the topic of certification exam preparation and results is limited. The majority of the collected works focus on study tips to prepare for a certification examination (Carselle, 2009; Gaedeke, 1995; Torkelson, 2008/2009; Gloe, 1999; Borch, 2015) with a few focusing on a particular exam (for example, Tittel (2004) discusses study strategies particular to the Microsoft Exam) or concentrating on a specific field (Derossis et. Al. (2004) examine the study habits of surgery residents and performance on American Board of Surgery In-Training examinations).

Specifically, Carselle (2009) recommends registering early (at least 6 months in advance) for the examination, Tittel (2004) advises to take practice tests to assess one's strengths and weaknesses, and Gloe (1999) discusses how to reduce test anxiety. Permyakova, Sheveleva & Smirnova (2017), however, found a connection between the preparation time and expectations of the students before taking the certification examination. The study also revealed a connection between candidates' expectations toward exam results and their age and level of language proficiency.

McClintock and Gravlee (2010) find that performance on the American Board of Anesthesiology/American Society of Anesthesiologists ITE (In-Training Examination) correlates with the performance on the ABA Part 1 (written) examination and a significant predictor of success in completing both the Part 1 and Part 2 examinations within the calendar year after the year of graduation from residency.

HYPOTHESES AND MEASURES

We examine three hypotheses to understand the correlations between various techniques and strategies used to prepare for professional certification exams and the corresponding exam results. These hypotheses are particularly important because the understanding of the research findings will allow for possible improved certification exam performance and provide direction for future research in areas that may improve test-taking strategies for professional certification exams.

Hypothesis 1: There is a relation between the choice of study method and the likelihood of passing the certification exam.

The study methods addressed in our research include a self-paced book, computer-based training, instructor-led training, and practice tests. All participants are asked how many days on average the participant spends using this method to prepare for the exam. The exam takers are also asked whether they would use this study method to study for another exam. The aim is to understand how confident an exam taker using the preferred study method(s) and how effective the preferred study method(s) is(are) for the exam taker's success. To the best of our knowledge, there is no empirical research that explores the relation between the study methods and the exam performance. Consequently, to fill this gap we find it relevant to test the hypothesis examining the relationship between the study methods and the exam performance.

Hypothesis 2: The ill-being of the exam taker has a negative relation with the likelihood of passing the certification exam.

The physical and psychological wellbeing of a test taker might influence the test performance of the test taker. The opposite of well-being which is ill-being of the exam taker such as fatigue, hunger, test anxiety, personal problems, momentary lapses of memory or daydreaming may affect an exam taker's performance. Sievertsen et al. (2016) found that exam scores of school children decrease if the exam is given later in the day. Thus, cognitive fatigue plays a role in exam performance. Test anxiety also has an impact on academic success. Chapell et al. (2005) found a negative and significant relation between test anxiety and grade point average (GPA) of both undergraduate and graduate students. Davis et al. (2008) found a strong correlation between test anxiety and SAT scores.

Perceived physical and psychological ill-being by the participant was assessed by five questions. The participants were asked to rank the level of being hungry, tired or fatigued, daydreaming, mental blocking or trouble focusing, panic anxiety, and having personal issues affected their exam performance. Each question was answered on a four-point Likert scale, ranging from 1 (not at all) to 4 (the whole time). It is possible that a rating item does not apply to a respondent, thus we add "not applicable" (N/A) to allow the participant an opportunity to opt-out of the question, instead of choosing an inaccurate answer. Specifically, we will test the following hypothesis:

Hypothesis 3: Unfavorable outside factors are negatively correlated with the exam taker's likelihood of passing the certification exam.

The outside factors that cannot be controlled by the exam taker such as the test room environment and test format confusion may influence the exam taker's performance. The outside factors are measured by four questions. For the first three questions, the participants were asked to rank the level of test format confusion, noise, the temperature had an impact on their performance. Each question was answered on a four-point Likert scale, ranging from 1 (not at all) to 4 (the whole time). The exam takers were also asked to rank whether the time allotted for the exam was enough or not. The response options were anchored on a seven-point scale from 1 (strongly disagree) to 7 (strongly agree). The response "not applicable" (N/A) was added. That is being said, we anticipate:

STATISTICAL ANALYSIS OF DEMOGRAPHICS, STUDY METHODS, AND STUDY HABITS

Our research utilizes a survey method to collect data to test our hypothesis. The survey consists of questions related to study strategies and study habits of exam takers to fulfill our research purpose of measuring the relation between exam preparation techniques, strategies, and exam results. The time span of data collection was June 2018 through December 2018, and 94 surveys were administered and collected at Computerminds.com training and testing center in Euless, Texas.

We consider several demographic variables to control for the impact of each demographic variable on the exam performance. These variables include age, gender, education, work status, and income. Age has seven categories ranging from 1 (18-24) to 7 (75 and older). The gender dummy for the two categories "male" and "female" is created (1=Female, 0=Male) to control for the impact of each group on the exam performance. Education has five categories ranging from 1 (High school) to 5 (Doctorate degree). Work status (0=Unemployed, 1=Part-time, 2=Full-time) was included as a control variable to examine the impact of work status on exam performance. Income was represented by 7 categories ranging from 1 (Less than $25,000) to 7 ($150,000 or more).

A total of 94 people who took certification exams from a test center in Texas participated in this study. Statistical analysis of participants' demographics is presented in Table 1. The majority of respondents are 54 years old or younger (84.1%). In this sample, 70.2% of exam takers are male, 29.8% are female. The majority of participants hold a bachelor's degree (55.3%), whereas 23 test takers have high school/GED or associate degree (24.5%). 16 exam takers hold a master's degree (17%). Of 94 respondents 73 (77.7%) were unemployed when the survey was administered, 21 (22.3%) were working either part-time or full-time. Regarding income, most of the participants' household income is less than $75,000 (67.3%), whereas 30 participants claim a household above $75,000 (32.6%).

TABLE 1
DESCRIPTIVE STATISTICS OF DEMOGRAPHICS

Variables		Number of Observations	Percentage
Age			
	18-34 years	23	24.5%
	35-54 years	56	59.6%
	55-74 years	15	15.9%
Gender			
	Female	28	29.8%
	Male	66	70.2%
Education			
	None	3	3.2%
	High School/GED	9	9.6%
	Associate Degree	14	14.9%
	Bachelor's degree	52	55.3%
	Master's degree	16	17%
	Doctorate	0	0%
Work Status			
	Unemployed	73	77.7%
	Part-time	11	11.7%
	Full-time	10	10.6%
Income			
	Less than $25,000	5	5.4%
	$25,000 to $49,999	35	38%
	$50,000 to $74,999	22	23.9%
	$75,000 to $99,999	17	18.5%
	$100,000 to $149,000	8	8.7%
	$150,000 or more	5	5.4%

We first study the findings related to hypothesis 1, that there is a relation between the choice of study method and the likelihood of passing the certification exam we asked respondents to share the method used to study for the exam (options include self-paced books, computer-based training, Instructor-led training, practice tests, and other) and whether they passed or failed the exam that they took. The participant's study methods (whether self-paced books, computer-based training, instructor-led training, practice tests, or other), days spent studying, and success rates are presented in Table 2.

TABLE 2
PARTICIPANT'S STUDY METHODS, DAYS SPENT AND SUCCESS RATES

Study Method	Percentage of participants who chose this study method	Percentage of participants who will use this method for another exam	How many days on average did a test taker spend using this method to prepare for the exam?	Percentage of Pass and Fail among the test takers who chose this method	
				Pass the Certification Exam	**Fail the Certification Exam**
Self-paced Books	23.9%	80%	14	86.4%	13.6%
Computer-based Training	87.2%	96.5%	7	86.6%	13.4%
Instructor-led Training	89.7%	100%	3	84.6%	15.4%
Practice Tests	84.1%	97.2%	7	87.8%	12.2%
Other	6.8%	100%	5	50%	50%

Most survey respondents' study for the certification exam utilizing multiple study methods. The most preferred study method is instructor-led training, and 100% of participants confirm that they will use this study method for another exam. On average it takes 3 days to get ready for the certification exam using this study method. The least preferred study method is self-paced books. It takes longer for an exam taker using this study method to get prepared for the certification exam. All study methods except "other" generate a high percentage of passing rates. The practice test results in the highest percentage of passing rate, consequently an exam taker should consider using this study method to best situate themselves to pass the certification exam.

The study habits of the test takers are presented in Table 3. The study habits were compared to the exam results (pass or fail) and include whether a test taker studied alone or in a group, the location where they studied (whether home, at a coffee shop, at the library, or other), the preferred time of day to study (choices include 12 am – 8 am, 8 am – 4 pm, or 4 pm – 12 am), how long each study session was (less than two hours, two to four hours, or more than four hours), how much in advance of the exam did they start preparing (1-2 weeks, 3-4 weeks, 1-2 months, or more than 2 months), and how many total preparations they had before the exam (1-5 sessions, 6-10 sessions, 11-16 sessions, or more than 16 sessions).

TABLE 3
STUDY HABITS OF THE TEST TAKERS

	Pass the Certification Exam				Fail the Certification Exam			
Study alone or with a group	Alone		With 1+ people		Alone		With 1+ people	
	87.2%		12.8%		71.4%		28.6%	

	Home	Coffee Shop	Library	Other	Home	Coffee Shop	Library	Other
Where did you study the most?	68.3%	7.6%	1.3%	22.8%	63.5%	14.2%	7.1%	14.3%

	12 am-8:00 am		8:00 am-4:00 pm	4:00 pm-12:00am	12 am-8:00 am		8:00 am-4:00 pm	4:00 pm-12:00am
What time of the day you study the most?	20.5%		42.4%	37.1%	38.5%		53.8%	7.7%

	Less than 2 hours		2 to 4 hours	More than 4 hours	Less than 2 hours		2 to 4 hours	More than 4 hours
How long were each study session?	30.4%		45.6%	24.1%	53.9%		38.5%	7.7%

	1-2 weeks	3-4 weeks	1-2 months	More than 2 months	1-2 weeks	3-4 weeks	1-2 months	More than 2 months
How much in advance of the exam did you start preparing?	62.1%	13.6%	15.2%	9%	46.2%	30.8%	15.4%	7.7%

	1-5 sessions	6-10 sessions	11-16 sessions	More than 16 sessions	1-5 sessions	6-10 sessions	11-16 sessions	More than 16 sessions
How many total preparations you had before the exam?	60.9%	23.4%	9.4%	6.3%	50%	33.3%	16.7%	0%

We compare "study alone" in the pass and fail group and we find that more respondents that pass prefer to study alone and at home. The majority of those that passed studied between 8:00 am-4:00 pm and those that study during the night (4:00 pm-12:00 am) is lowest for those that failed the exam. We found that the length of the study sessions differs for the pass group and the fail group. Those that failed mostly study for less than two hours, while those that pass mostly study between 2 and 4 hours. Those that passed started studying right before the exam (1-2 weeks in advance of the exam) and have 1-5 total study preparation sessions before the exam.

We also examine the well-being of test-takers during the exam and possible outside factors affecting test-takers (see Table 4). The results in Table 4 depict the descriptive statistics related to Hypothesis 2, that

the ill-being of the exam taker has a negative relation with the likelihood of passing the certification exam, and hypothesis 3, that unfavorable outside factors are negatively correlated with the exam taker's likelihood of passing the certification exam. The factors considered regarding the well-being of the test include experiencing hunger during the exam, being tired or fatigued, daydreaming, mental block or trouble focusing, experiencing panic/anxiety, or dealing with personal issues affected one's test performance. The outside factors that are considered relating to hypothesis 3 that might affect one's testing performance include feeling that the test format was confusing, the presence of noise, the temperature of the exam room, or that the time allotted was not enough, all of which might have affected one's testing performance.

TABLE 4
THE WELL-BEING AND OUTSIDE FACTORS AFFECTING TEST TAKERS

	Pass the Certification Exam		Fail the Certification Exam	
	Yes	*No*	*Yes*	*No*
Do you feel that being hungry affected your test performance?	66%	34%	62%	38%
Do you feel that being fatigued affected your test performance?	70%	30%	57%	43%
Do you feel that being daydreaming, mental block or trouble focusing affected your test performance?	59%	41%	77%	23%
Do you feel that panic/anxiety affected your test performance?	83%	17%	100%	0%
Do you feel that personal issues affected your test performance?	77%	23%	79%	21%
Do you feel that test format confusion affected your test performance?	45%	55%	62%	38%
Do you feel that noise affected your test performance?	38%	62%	50%	50%
Do you feel that temperature affected your test performance?	35%	65%	58%	42%
Do you feel that time allotted was NOT enough?	79%	21%	73%	27%

The results show that, overall, participants believe that panic/anxiety is the most important factor that affected their test performance (100% of those that failed the test attribute this factor to affect the outcome of their testing experience). The presence of outside noise was the least bothersome for those that failed their exam, and the temperature of the testing room was the least bothersome for those that passed their exam. To statistically test hypothesis 1, hypothesis 2, and hypothesis 3, we utilize regression analysis that we will discuss next.

STATISTICAL ANALYSIS OF MEASUREMENT VARIABLES AND REGRESSION RESULTS

The Cronbach's alpha is used to measure internal consistency of items for the same construct on the survey. We have two constructs: The ill-being of the test taker, and outside factors. The ill-being of a test taker is measured by five questions, whereas outside factors are measured by four questions.

The Cronbach's alpha is 0.76 and above 0.7 for exam taker's ill-being representing an adequate internal consistency. Inter item correlations between the items are above 0.3 and less than 0.8, consequently all five questions are correlating with the others and measuring the same thing: The ill-being of the exam taker. The Kaiser-Meyer Olkin measure of sampling adequacy was 0.78 and significant at 1%. Given these overall indicators, factor analysis was deemed to be suitable with five questions. Initial eigenvalues indicated that the first three factors explained 51%, 16% and 14% of the variance respectively. Only the first factor had eigenvalues over one and a solution for one factor was examined using oblimin rotation. The one-factor solution which explained 51% of the variance was preferred because of the "levelling off" of eigenvalues on the scree plot after the first factor.

The alpha score for the outside factors is 0.71 indicating a good internal consistency. The inter-item correlations of this construct is between 0.3 and 0.6. The Kaiser-Meyer Olkin measure of sampling adequacy was 0.77 and significant at 1%. Initial eigenvalues indicated that the first factor explained 61% of the variance. The one-factor solution was preferred because of the "levelling off" of eigenvalues on the scree plot after the first factor.

TABLE 5
FACTOR LOADINGS WITH PRINCIPLE COMPONENT ANALYSIS

Item	Ill-being of the Test Taker	Outside Factors
Do you feel that being hungry affected your test performance?	0.83	
Do you feel that being tired or fatigue affected your test performance?	0.63	
Do you feel that being daydreaming, mental block or trouble focusing affected your test performance?	0.61	
Do you feel that panic/anxiety affected your test performance?	0.71	
Do you feel that personal issues affected your test performance?	0.77	
Do you feel that test format confusion affected your test performance?		0.85
Do you feel that noise affected your test performance?		0.76
Do you feel that temperature affected your test performance?		0.73
Do you feel that time allotted was NOT enough?		0.77

If univariate skewness and kurtosis are below 2 and 7 respectively, we can assume a normal distribution for the data (Finney & DiStefano, 2006). Our data indicated that the skewness and kurtosis were well within a tolerable range for a normal distribution.

A binary logistic model was fitted to the data to test our first hypothesis regarding the relationship between the likelihood that an exam taker passes the exam and the study method that he or she chose. The study methods included self-paced books, computer-based training, instructor-led training, and practice

tests. The "other" was included as an option. Most participants did not indicate what included in the other category. However, some of the methods that were mentioned in this category were instructor PowerPoint slides and handwritten flashcards. The exam taker's performance was measured by a dummy variable. If the exam taker passed the certification exam when the survey was conducted, then the dummy variable takes the value of 1, and 0 otherwise. The same method is used for the study methods. One dummy variable is created for each study method, therefore for a total of five dummy variables are created. The dummy variable takes the value of 1 if the test taker chose that study method, and 0 otherwise.

TABLE 6
THE LOGISTIC REGRESSION ANALYSIS OF HYPOTHESES

		Binary Logistic Regression		Hierarchical Logistic Regression			
				Model 1		Model 2	
		β	e^{β} (Odds Ratio)	β	e^{β} (Odds Ratio)	β	e^{β} (Odds Ratio)
	Constant	-0.355 (2.290)	0.701	0.568 (2.907)	1.765	0.262 (3.150)	1.300
Study Methods							
	Self-paced Books	0.447 (0.940)	1.563	1.282 (1.350)	3.601	1.885 (1.616)	6.587
	Computer-based Training	0.977 (0.887)	2.657	1.250 (0.948)	3.489	1.209 (1.174)	3.352
	Instructor-led Training	0.049 (1.290)	1.050	0.074 (1.361)	1.077	-1.288 (1.643)	0.276
	Practice Test	1.096 (0.982)	2.991	0.725 (1.015)	2.066	0.525 (1.063)	1.690
	Other	-1.898** (0.951)	0.150	-1.926* (0.985)	0.051	-1.460 (1.070)	1.889
Ill-Being		-	-	-0.63 (0.159)	0.939	-0.26 (0.173)	0.974
Outside Factors		-	-	-	-	-231 (0.207)	0.794
χ^2		10.341, df=10, p>0.10		9.271. df=11, p>0.10		9.977, df=12, p>0.10	
Nagelkerke R^2		0.208		0.219		0.256	

Controls are age, gender, income, education and work status (omitted from the table). "**" and "*" indicate significance at 5% and 10% level respectively. Each study method takes the value of 1 if the participant chose this study method, 0 otherwise.

The statistical significance of individual regression coefficients (i.e., βs) is tested using the Wald chi-square statistic. Demographics, which are omitted from the table, are not significant predictors of an exam taker's exam performance at the 5% significance level, therefore, they are not related to the odds of an exam taker's passing or failing the certification exam. As shown in Table 5, the choice of study method is also irrelevant to the likelihood that an exam taker passes the exam except the category "other" (Hypothesis 1 is rejected). The exam takers who chose study methods other than self-paced books, computer-based training, instructor-led training, and practice test were less likely to pass the certification exam. An odds

ratio of less than 1 for this variable confirm this finding. Although none of the study methods were significant predictors of exam performance, exam takers who chose self-paced books to study for the exam were 3.601 times more likely to pass the exam than the ones who did not choose this method.

When the variable of interest, ill-being of the test takers, was added to the model (Model 1), the Chi-square value was not significant which indicates that adding ill-being did not improve the ability of the model to predict the exam performance of the participants. The ill-being of the exam takers was a negative (as predicted) but not a significant predictor of exam taker's likelihood of passing the certification exam. Therefore, Hypothesis 2 is rejected. The third variable of interest is the outside factors, such as test room environment and test format confusion. Contrary to our expectations, the outside factors were not a significant predictor (Model 2) although the sign of this variable was as expected (Hypothesis 3 is rejected). The chi-square value of the model was not significant. Thus, adding this variable to the model did not significantly improve the ability of the model to predict the likelihood of passing a certification exam.

CONCLUDING REMARKS AND FUTURE RESEARCH

Certifications are in high demand and can help professionals stay up to date with industry trends, enhance their education, and boost their careers. Certifications can be both expensive and time-consuming to acquire, hence the need to find the optimal conditions to prepare for testing success. In this research, we study the relationship between the study method used by the test-taker to prepare for the certification exam, the test taker's well-being during the exam, and outside factors that might have affected the test taker, all on the test-takers exam performance, that is, whether the test-taker passed or failed the exam. These results aim to find criteria that a test-taker can use to ensure optimal performance during their testing experience.

We collected data from 94 participants and studied three hypotheses related to test-takers performance. We found that the most preferred study method is instructor-led training, and 100% of participants confirm that they will use this study method for another exam and on average it takes 3 days to get ready for the certification exam using this study method. The least preferred study method is self-paced books. It takes longer for an exam taker using this study method to get prepared for the certification exam. All study methods except "other" generate a high percentage of passing rates. The practice test results had the highest passing rate, and consequently, an exam taker should consider using this study method to best situate themselves to pass the certification exam.

We find that more respondents that pass prefer to study alone, at home, and studied between 8:00 am-4:00 pm, and have study sessions that last between 2 and 4 hours. Those that passed also started studying right before the exam (1-2 weeks in advance of the exam) and have 1-5 total study preparation sessions before the exam. We found that those that failed the exam attributed the presence of panic/anxiety to their unfavorable results and that the presence of outside noise was the least bothersome for those that failed their exam, and the temperature of the testing room was the least bothersome for those that passed their exam.

There are a few limitations to this research. One is that participants were allowed to choose multiple study methods. It may be interesting to measure the impact of the most preferred study method on exam performance. In the literature, there are many empirical papers that show a direct link between test anxiety and academic success. Test Anxiety Inventory (TAI) is the common assessment tool to measure the test anxiety of the students. TAI (short version) could be used to measure the test anxiety instead.

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