Just-in-Case or Just-in-Time Training? – Excerpts from a Doctoral Research Study

Devshikha Bose(✉)

Instructional Design and Educational Assessment,
Boise State University, Boise, ID, USA
devshikhabose@boisestate.edu

Abstract. This paper is an excerpt on the author's doctoral study titled "Effects of Just-in-Time online training on knowledge and application of the Sheltered Instruction Observation Protocol (SIOP®) Model among in-service teachers." The specific focus of the report is on an aspect of the study, which sought to determine whether there was any statistically significant difference between learners who received Just-in-Time (JiT) versus those who received Just-in-Case (JiC) instruction. Results from the data analysis revealed no significant difference in knowledge or application skills between the JiT and JiC groups. However, there was an increase in learner application of SIOP® Model principles in classroom teaching, for both groups. JiT training did not emerge as a better training strategy than JiC training. The main benefit of the training delivered through this study seemed to be in increasing application and not knowledge.

Keywords: Just-in-Time training · Just-in-Case training · SIOP® · Dick and carey systems approach model · Online teacher professional development

1 Introduction

The timing of training may have an impact on the learners' motivation for using it [1]. Just-in-Time (JiT) training provides learners with the information required to complete a job at the moment it is needed [2], rather than training people just in case they may need the knowledge and skills in future. Just-in-Case (JiC) training may be a wasteful use of resources [3]. JiT training is a form of inductive teaching that occurs in situations in which the instructor starts by challenging the student with a specific problem situation [4]. Students faced with a problem feel the need for gaining access to facts, skills, and concepts, which are then provided by the instructor as the situation demands. This may lead to a deeper level of learning.

The primary outcome of JiT training is a context-specific improvement of knowledge and performance [5]. A meta-analysis of the effectiveness of JiT training as an adult learning method revealed that this training method was most effective when used with actual practitioners who had the opportunity to apply their training to their professions.

The advantages of JiT training appear to be many [1]. JiT reduces the time lapse between learning and the application, ensuring that a minimum amount of forgetting

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takes place [2]. JiT training delivered in small chunks is often more relevant to the needs of the learner, and therefore may be more efficient than lengthier courses. Although the costs of creating electronic JiT training packages may be high initially, it is more cost effective in the long run when factors like the time and money spent in travelling are considered. However, JiT training is not a "panacea" [2] training solution, especially when the training does not meet the needs of the situation. While materials used for on-going training are developed and updated on a regular basis, materials for JiT training are "mandated by an emerging situation" [6].

2 Purpose of Study

The phenomenon under study in this research was the efficacy of the JiT inductive training context versus the JiC training context, through an online medium, on learner knowledge acquisition and application abilities [1]. It is important to compare the JiT training context versus the JiC training context because such research will add to the existing literature in the field of teacher professional development training methods, with specific emphasis on how optimum timing of training can prevent waste of resources.

The purpose of this study was to determine whether there was a difference in knowledge and application of the SIOP® Model among in-service teachers who participated in an online professional development course on the SIOP® Model [1]. Although these teachers all participated in the same course, information on the number of English Language Learners (ELLs) in their classrooms was used to distinguish teachers who received the training in a JiT context, as opposed to those who received the training in a JiC context. This research may help establish the effects of providing JiT instruction on the teachers' knowledge and application skills of the SIOP® Model as compared to the knowledge acquisition and application potential of JiC training. The following research questions guided the focus of the quantitative portion of the study pertaining to the impact of JiT verses JiC training on learning:

1. Is there a significant difference in achievement between Just-in-Time recipients and Just-in-Case recipients of SIOP® Model training, as measured by a knowledge posttest, after controlling for pre-treatment knowledge?
2. Is there a significant difference in application of SIOP® principles between Just-in-Time recipients and Just-in-Case recipients of SIOP® Model training, as measured by the SIOP® protocol and the SIOP® Usage Survey, after controlling for pre-treatment application?

3 Review of Literature

A survey of existing research on JiT and JiC training revealed that there are only a few empirical studies published in this area [1]. Most of the available studies are anecdotal and suggestive in nature. In areas of human resource training such as that of emotional intelligence, it has been reported that there is hardly any literature on short-term JiT

training programs [7]. The following review is based on the available empirical, anecdotal and suggestive publications. This literature base suggests that JiT training may be more effective than JiC training.

JiT training provides a learner with the information required to complete a job when it is required [2]. JiT learning systems provide training when and where it is needed rather than providing training to learners through extensive traditional classroom courses well before such knowledge is required [6] It has been suggested that JiT training is more feasible because it minimizes chances of "training waste" [3]. Leaners get the training they need, when they need it for immediate use rather than when training happens to be available. Thus, training people "just in case" they will need the knowledge and skills in future may be a wasteful use of resources [3]. Moreover, JiT learning enables learning in more meaningful or authentic situations, when the learner has a professional context in which the relevant training can be immediately applied [8].

JiT learning can be helpful for adult learners who are trying to take a refresher course on certain skill sets in areas like mathematics instead of taking complete courses which might be time consuming [9] Also, JiT can help learners solve specific problems by making very specific knowledge sets immediately available [10, 11]. With adult learners, JiT learning methods reflect the changing nature of adult learning in the "internet era" where the "old model of learning" or the "warehouse" is being replaced by the "Just-in-Time system of information acquisition" [12].

People usually learn in response to a 'need' [13]. When the need for learning a particular topic is not evident, the learner ignores, rejects, or fails to assimilate it in any meaningful manner. However, when learners feel the need for learning a particular thing they usually make effective use of training resources. Sometimes it is possible for teachers to act as facilitators and providers of JiT scaffolding to students [14]. Students indicated that teacher scaffolding was beneficial when they actually needed it rather than being always available. Thus "delayed scaffolding and feedback" were identified as being more beneficial to learning [14].

Pilot studies of a National Science Foundation (NSF) funded project called The Math you Need when You Need it (TMYN), using the JiT and the necessity principle of teaching, revealed that online, asynchronous learning modules were successful in remediating community college and university student learning in geosciences [15]. Increases in scores from the pre to the posttest, as well as students' reported perceptions of the usefulness of TMYN, demonstrated the success of JiT teaching in this research study.

4 Method

Research Question 1 (see above) sought to determine whether there was a significant difference in knowledge achievement after participation in an online SIOP® training course, between in-service teachers who received JiT training in the SIOP® Model and in-service teachers who received JiC training in the SIOP® Model [1]. The answer was determined through an analysis of differences in scores between Pre and Post-instruction Knowledge Tests taken by the participants. Also, the change in knowledge of SIOP® Model principles after participation in the instruction for the JiT group,

was compared with the change in knowledge of SIOP® Model principles for the JiC group. This helped establish whether learners acquire more knowledge through training if they receive training in a JiT context as opposed to training in a JiC context.

Research Question 2 (see above) sought to determine whether there was a significant difference in application of SIOP® Model principles after participation in an online SIOP® training course, between in-service teachers who received training in the JiT context versus teachers who received training in the JiC context [1]. The answer was determined through an analysis of differences in scores between Lesson Plans and SIOP® Usage Surveys submitted by participants before and after instruction. Also, the change in application of SIOP® Model principles after participation in the instruction for the JiT group, was compared with the change in application of SIOP® Model principles for the JiC group though an analysis of a SIOP® Usage Survey. These comparisons helped establish whether learners increase application of SIOP® principles after they receive training in a JiT context versus training in a JiC context.

5 Research Design

A mixed research design was used for this study such that both quantitative as well as qualitative data was collected [1]. In order to gain a better understanding of the research problem, triangulation of numeric data from a quantitative perspective and analytical data from a qualitative view [16] was completed.

This paper focuses on the quantitative and not the qualitative aspects of the study. As such, it does not discuss the data obtained from the Focus Group Meetings. The data from the Demographic Information Survey is referenced as appropriate to the context of discussion. The following paragraph summarizes the Research Design of the entire study:

Participants completed a Demographic Information Survey on the basis of which they were split into two distinct groups – JiT and JiC. Both groups completed the Pre-Instruction Knowledge Test and submitted the Pre-Instruction Lesson Plan [1]. They also took the SIOP® Usage Survey. Then, both groups received the treatment instruction (online SIOP® course). After completing the course, both group participants took the Post-Instruction Knowledge Test and submitted the Post-Instruction Lesson Plan. They also took the SIOP® Usage Survey and participated in the Focus Group Meetings.

6 Participants and Sampling

The participants in this study included K-12 in-service teachers from the state of Idaho, who registered for an online SIOP® professional development course during the summer 2012 semester [1]. The teachers self-selected to participate in this course offered by the research institution (a public Intermountain West university). Invitations to register for the online professional development course were emailed to every K-12 teacher in Idaho. The teachers who enrolled in the course constituted a self-selected sample of convenience. A total of 43 (N = 43) participants were included for data collection purposes in this study. However, different phases of the study had different participant numbers depending on their response rates on data collection instruments.

7 Instruments

While a total of seven assessment instruments were used in the dissertation study only four instruments were used to gather quantitative data data on the JiT and JiC training aspects: A Demographic Information Survey, Pre and Post-instruction SIOP® Knowledge Tests; a lesson plan evaluation rubric (the SIOP® protocol); and a researcher-created self-reported SIOP® Usage Survey instruments, based on the components of the SIOP® Model [1].

8 Procedures

The treatment instruction used in this study consisted of an online training on the SIOP® Model. The course was self-paced and was of four weeks duration. It had four modules. Students earned a single professional development credit upon completing its requirements [1].

Before gaining access to the treatment instruction (online SIOP® curriculum) both JiT and JiC groups completed the Demographic Information Survey, the Pre-instruction Knowledge Test, submitted the Pre-instruction Lesson Plan, and completed the SIOP® Usage Survey [1]. Participants were assessed on their pre-instruction knowledge (determined by the Pre-instruction Knowledge Test) and application (determined by analysis of their Pre-instruction Lesson Plan and SIOP® Usage Survey). After receiving the treatment instruction, both JiT and JiC groups completed a Post-instruction Knowledge Test, submitted a Post-instruction Lesson Plan, completed a SIOP® Usage Survey, and participated in a Focus Group Meeting (data not reported here).

9 Treatment Development and Data Collection

The online curriculum was developed keeping in mind the principles of good Instructional Systems Design [1]. Instructional System refers to the arrangement of resources and procedures used to facilitate learning [17]. This study used the Dick and Carey Systems Approach Model of instructional design. The phases in this design model include: Identification of instructional goals, instructional analysis, analysis of the learners and the context; writing of performance objectives; development of criterion referenced assessment instruments; development of an instructional strategy; development and selection of instructional materials; design and delivery of formative and summative evaluations [18]. In order to answer the research questions focusing on the JiT and JiC training modalities, data were collected in five phases using the five instruments (only four reported in this paper).

10 Data Analysis

A Repeated Measures Analysis of Variance was used to analyze data [19]. This statistical analysis procedure was chosen because the same participants were tested twice, generating three sets of pre and post-treatment instruction scores using three different test instruments [20]. This data were analyzed for within and between subjects effects.

Research Question 1. In order to answer Research Question 1, a repeated measures ANOVA with one between and one within subjects factor, was used to determine any significant difference in achievement on the posttest between the two groups, while controlling for pre-instruction differences [21].

Research Question 2. In order to answer Research Question 2, an analysis of the lessons submitted by the JiT and JiC groups before and after the delivery of the treatment instruction was conducted using the SIOP® protocol, in order to determine difference in performance which may be attributed to level of need for the online treatment instruction [1].

The difference in mean scores between the Pre and Post-instruction Lesson Plans was calculated for both JiT and JiC groups to ascertain significant differences in participant SIOP® application [1]. A repeated measures ANOVA, with one between and one within subjects factor, was used to determine any significant difference in application of SIOP® principles between the two groups on the post-instruction lesson plan, while controlling for differences on the pre-instruction lesson plan [21].

Research Question 2 was also answered using the SIOP® Usage Survey [1]. For both JiT and JiC groups, an analysis of the results from the SIOP® Usage Survey administered before and after the delivery of instruction was used to determine changes in implementation levels of SIOP® Model principles in actual classroom practice.

The difference in mean scores between the Pre and Post-instruction SIOP® Usage Survey was calculated for both JiT and JiC groups to ascertain significant differences in participant application of SIOP® principles [1]. A Repeated Measures ANOVA with one between and one within subjects factor, was used to determine any significant difference between the two groups [21].

11 Results

11.1 Data Analysis for Research Question 1

The Pre and Post-instruction Knowledge Test instrument provided data to answer Research Question 1 of this study [1]. Thirty-nine or 90.6 % (n = 39) participants completed the Pre and Post-instruction Knowledge Tests. Out of this number, there were 21 participants in the JiT group and 18 in the JiC group who completed both the pre and posttest. Scores from these tests and a value for the JiC versus the JiT variable were obtained. Research Question 1 was addressed by using the total score from all the assessment items in the Pre and Post-instruction Knowledge Tests. There were 28 multiple-choice items in both the Pre and Post-instruction Knowledge Tests. The total score was calculated as a percentage correct.

The Pre-instruction Knowledge Test, the JiT group had a higher average performance (M = 86.9, SD = 9.0) than the JiC group (M = 84.5, SD = 5.9) [1]. In the Post-instruction Knowledge Test, the JiT group had a higher average performance

($M = 87.6$, $SD = 10.9$) than the JiC group ($M = 86.5$, $SD = 12.0$). Both groups improved from pre to post test in terms of SIOP® knowledge; however, it was determined (see below) that this improvement was not significant for either group.

Since there were violations to the assumptions of Normality and Homogeneity of Variances, the same comparisons were made using the non-parametric equivalent tests with a Bonferroni Correction for the *p*-value [1]. Two Mann-Whitney U Tests, which is the non-parametric equivalent of the independent samples *t*-test, were calculated to compare the JiC and the JiT groups on the pretest scores and the posttest scores. Two Wilcoxon Signed Ranks tests, which is the non-parametric equivalent of paired *t*-test, were conducted [20] to compare the pre- and post- test scores for the JiT group and for the JiC group. The results were similar to that of the parametric RMANOVA.

The sample size for the Mann-Whitney U test was 39 ($n_{JIT} = 21$, $n_{JIC} = 18$) [1]. No statistically significant difference was found between the two groups for the Pre-instruction Knowledge Test ($Z = -1.054$, $p = .292$, $p_{Bonferroni} = 1$) or for the Post-instruction Knowledge Test ($Z = -0.242$, $p = .809$, $p_{Bonferroni} = 1$).

For the Wilcoxon Signed Rank test, the sample size for the JiT group was 21 ($n = 21$) and the JiC group was 18 ($n = 18$) [1]. There was no significant difference from the pre-test to the posttest scores for either the JiT ($Z = -1.551$, $p = .121$, $p_{Bonferroni} = .484$) or JiC groups (-0.586, $p = .558$, $p_{Bonferroni} = 1$).

RMANOVA Results. A repeated measures analysis of variance was used to assess whether there was a significant difference in performance before and after instruction, whether there was a difference in the groups, and whether there was a significant interaction between groups and pre – versus - posttests, as demonstrated by scores in the Pre and Post-instruction Knowledge Tests [1]. There was no statistically significant interaction with F (1, 37) = .08, and $p = .76$, between participant performance and whether participants were in the JiT or JiC groups. There was no statistically significant increase in knowledge after instruction with F (1, 37) = .36, and $p = .55$. The JiT and the JiC groups did not perform significantly different from each other on average with F (1, 37) = .08, and $p = .76$.

11.2 Data Analysis for Research Question 2

Pre and Post-instruction Lesson Plans were used to answer Research Question 2 of this study [1]. Pre and Post-instruction Lesson Plan data were collected from 36 or 83.7 % participants. Out of this number, there were 19 participants in the JiT group and 17 in the JiC group. Scores from these lesson plans and a value for the JiC versus the JiT variable were obtained.

Research Question 2 was addressed by analyzing performance scores on the Pre and Post-instruction Lesson Plans submitted by the participants as well as by analyzing their scores on the researcher-created SIOP® Usage Survey [1]. The grading rubric used for the Pre and Post-instruction Lesson Plans was the SIOP® protocol which has already been found to be a reliable and valid instrument with an inter-rater correlation of .99 [22].

The Pre-instruction Lesson Plan, the JiT group had a higher average performance ($M = 18.7$, $SD = 14.0$) than the JiC group ($M = 15.6$, $SD = 10.0$) [1]. In the

Post-instruction Lesson Plan, the JiT group had a higher average performance ($M = 58.3$, $SD = 10.8$) than the JiC group ($M = 58.1$, $SD = 12.3$). Both groups improved significantly from pre to post test in terms of SIOP® application.

RMANOVA Results. A repeated measures analysis of variance was used to assess whether there was a significant difference in performance before and after instruction, whether there was a difference in the groups, and whether there was a significant interaction between groups and pre-versus-post-tests as demonstrated by scores in the Pre and Post-instruction Lesson Plans [1].

There was no statistically significant interaction with F (1, 34) = .26, and $p = .61$ between participant performance and whether participants were in the JiT or JiC groups [1]. There was a statistically significant increase in SIOP® application after instruction for both groups, as demonstrated by increased scores in the Post-instruction Lesson Plan with F (1, 34) = 210.73, and $p = \leq .001$. However, the JiT and the JiC groups did not perform significantly different from each other with F (1, 34) = .26, and $p = .61$.

Pre and Post-instruction SIOP® Usage Surveys were also used to answer Research Question 2 of this study [1]. Pre and Post-instruction SIOP® Usage Survey Data were collected from 33 or 76.7 % ($n = 33$) participants. Out of this number, 17 participants were from the JiT group and 16 from the JiC group. Scores from these surveys and a value for the JiC versus the JiT variable were obtained. Both groups displayed a statistically significant improvement from pre to post test in terms of SIOP® application.

The Pre-instruction SIOP® Usage Survey, the JiT group had a higher average performance ($M = 3.9$, $SD = .37$) than the JiC group ($M = 3.8$, $SD = .32$) [1]. In the Post-instruction SIOP® Usage Survey, the JiT group had a higher average performance ($M = 4.1$, $SD = .38$) than the JiC group ($M = 4.0$, $SD = .39$). Both groups improved significantly from pre to post test in terms of intended SIOP® application.

RMANOVA Results. A repeated measures analysis of variance was used to assess whether there was a significant difference in performance before and after instruction, whether there was a difference in the groups, and whether there was a significant interaction between groups and pre- versus post-tests as demonstrated by scores in the Pre and Post-instruction SIOP® Usage Survey [1].

There was no statistically significant interaction with F (1, 31) = .00, and $p = .94$ between participant performance and whether participants were in the JiT or JiC groups [1]. There was a statistically significant increase in SIOP® application after instruction, as demonstrated by increased scores in the SIOP® Usage Survey, for both the JiT and JiC groups with F (1, 31) = 8.42, and $p = < .01$. However, the JiT and the JiC groups did not perform significantly different from each other with F (1, 31) = .00, and $p = .94$.

12 Findings and Conclusions

This study did not produce evidence to answer Research Question 1 affirmatively [1]; that is, there appears to be no difference in knowledge acquisition between the JiT and JiC groups. However, the timing of the training, the high pre-instruction SIOP® knowledge within each group, the small number of participants, and other limitations

noted for this study may have led to the non-significant results. Alternatively, this study may provide support for the hypothesis that JiC training is as effective for knowledge acquisition as training in a JiT context, and that training, in the absence of an immediate need, does not necessarily waste time or resources. Further research to examine this perspective is needed.

Similarly, this study also did not produce evidence to answer Research Question 2 affirmatively [1]; that is, there appears to be no difference in SIOP® application after receiving training between the JiT and JiC groups. However, the timing of the training, the high pre-instruction SIOP® application within each group, the small number of participants, and other limitations noted for this study, may have led to the non-significant results. Alternatively, this study may provide support for the hypothesis that JiC training is as effective for application as training in a JiT context, and that training, without an immediate need, does not necessarily waste time or resources.

13 Recommendations for Further Research

The findings of this research study lead to various potential opportunities for further research [1]. This study was restricted to participants within the state of Idaho. Therefore the generalizability of this study is limited. A future study could be conducted which could include in-service teachers from states outside Idaho. Since this course was delivered online, including participants at large distances should not be a problem.

The sample size (N = 43) of this study was relatively small [1]. Further research could be conducted with more participants. Discussions during the Focus Group Meetings revealed that the timing of the course was unsuitable for most teachers since it was the end of the school year, when teachers are usually busy with their professional duties. This may be one reason why some potential participants did not register for the course. Therefore it is recommended that future courses should be delivered at a more suitable time.

While some of the instruments in this study (Lesson Plans based on the SIOP® Model, Usage Survey) demonstrate how participants plan to implement the SIOP® training acquired from this course, they do not demonstrate whether the teachers actually implemented SIOP® principles in their classroom [1]. A future study is recommended where teachers can be video-recorded delivering lessons in their actual classrooms, before and after receiving instruction. It is further recommended that a time-delayed posttest or evaluation be made to see the long-term retention and implementation levels of the training.

The duration of this course was only four weeks [1]. Within this short time, learners had to complete many reading assignments, quizzes, activities, lesson plans, surveys, and tests. Some experts suggest that short and isolated professional development workshops should be avoided [23]. Future courses should contain more regular opportunities for participant interaction and collaboration through activities like group discussions and projects.

Some participants mentioned in the Focus Group Meeting sessions (results not reported in this paper) that the online format of the course was a challenge, because

they did not have any prior experience in using *Moodle*, which was the delivery Learning Management System (LMS) of this course [1]. It is recommended that future courses should contain an in-built training module on the use of *Moodle* for learners who are not familiar with its use.

This study examined Just-in-Time training within the specific context of the SIOP® Model [1]. Additional research needs to be conducted to determine if the findings from this study could be replicated in other subject areas.

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