Chapter 4

Results

This study investigated the ability of the Innovation Adoption Profile (IAP) to indicate teachers' micro-adoption decisions and describe teachers' uses of digital annotation. Specifically, this study was designed to answer the following research questions:

1) To what extent does diffusion of innovations theory, as embodied in the Innovation Adoption Profile (IAP), indicate the micro-adoption decisions of secondary school teachers considering participating in a four-week trial of RepliGo™ digital annotation software?
2) What are the deep-usage post-adoption outcomes of using RepliGo™ digital annotation software among secondary school teachers?
3) What is the relationship between teachers' IAP results and their deep-usage post-adoption outcomes from the four-week trial of RepliGo™ digital annotation software?

Each research question was answered using separate data analyses. Data collected to answer question 1 were analyzed using both quantitative and qualitative analyses while data collected to answer questions 2 and 3 were analyzed using qualitative analyses.

Question 1 - To what extent does diffusion of innovations theory, as embodied in the Innovation Adoption Profile (IAP), indicate the micro-adoption decisions of secondary school teachers considering participating in a four-week trial of RepliGo™ digital annotation software?

As stated in the methods section, answering research question one relies on the results of a logistic regression analysis of data gathered using five surveys (i.e., demographics, the Individual Innovativeness Scale, the Perceived Organizational Innovativeness Scale, the Perceived Characteristics of Innovating Scale, and field trial participation) and the analysis of individual interviews from a sample of the participants. This section reports on the survey response rates, the results of each of survey, the logistic regression analyses, a summary of the analysis of the quantitative data, and the analysis of the interviews. The section concludes with a summary of the findings and the response to the research question.

Response rates. Workshops on digital annotation were attended by a total of 123 teachers. During each workshop, teachers were asked to complete four online surveys that made up the Innovation Adoption Profile (IAP) (i.e., demographics, the Individual Innovativeness Scale, the Perceived Organizational Innovativeness Scale, and the Perceived Characteristics of Innovating Scale) and a fifth survey to register their response to the dependent variable, whether or not they intended to participate in the field trial of RepliGo™. Completion of the surveys was voluntary, and 86% (n = 106) of the teachers (hereafter "participants") chose to do so.

Participants were instructed to complete all surveys during their workshop. Unanticipated technical complications (e.g., lack of network connectivity, server

overloading) associated with using a particular web-based survey tool combined with non-response on some items reduced the overall response rate (i.e., respondents who completed each question on each survey) to 47% (n = 50). A server overload event during the August workshops accounted for the majority of non-response, and this occurred during the last workshop on the final day of data collection, when the majority of participants were taking the fourth and fifth surveys. These were the Perceived Characteristics of Innovating Scale (D. R. Compeau & Meister, 2003), and the question asking their intention to participate in the field trial of RepliGo™, which was the dependent variable question. This event, combined with an intermittent network connection problem during the May workshops, resulted in different response rates for each survey.

Time constraints and distance between the researcher's location and the participants' school district hindered follow-up, but five participants did complete their surveys in the three weeks following the August workshop. One participant in a May workshop completed all surveys without providing a response to the dependent variable. During her follow-up interview the next day, she was asked for that response and it was included in the data. The total number of participants who provided usable data for the logistic regression analysis was 56. This represents an overall response rate of 53% from the original 106 participants. Separate response rates for each of the five surveys are displayed in Table 2. The number of respondents reflects the loss of data due to the technical complications.

Table 2

Response Rates for Each Survey in the Innovation Adoption Profile (IAP) Based on Number of Participants (N = 106)

Survey	Response rate percent (%)
Demographics	98
Innovativeness Scale	99
Perceived Organizational Innovativeness Scale	93
Perceived Characteristics of Innovating Scale	58
Intention to participate in field trail (dependent variable)	63

Demographics. Table 3 displays the descriptive statistics of the participants' demographics. Participants were predominately female (64%, n = 67), and the majority were high school teachers (84%, n = 87). Participants taught in a variety of content areas with 55% teaching English or Language Arts (n = 23), Social Studies (n = 14), World Language (n = 6), English as a Second Language (n = 5), or Special Education (n = 9). These content areas were thought to involve students in reading more than the other content areas, thereby having greater potential for adopting digital annotation.

Table 3

Participant demographics (N=104)

Demographic	Response	Percent (%)	Demographic	Response	Percent (%)
Gender	Male	36.00	Subject taught	English/Language Arts	22.12
	Female	64.00		Social Studies	13.46
Age group	22-25	6.73		Mathematics	13.46
	26-30	18.27		Science	12.50
	31-40	19.23		Fine Arts	7.69
	41-50	21.15		World Language	5.77
	51-60	24.04		ESL	4.81
	61+	10.58		Special Education	8.65
Educational attainment	4-year degree	54.81		Other	11.54
	Master's degree	41.35	Career moves	None	14.42
	Doctoral degree	1.92		One	20.19
	Professional degree	0.96		Two	15.38
	Other	0.96		Three	14.42
School type	High school	83.65		Four	9.62
	Middle school	16.35		Five or more	25.96

As explained above, the response rate was affected by unanticipated technical complications. Thereby responses to some portion of the surveys were not collected from 48% of the participants and were not included in the logistic regression analysis. The equivalence of these two groups (i.e., participants who completed all surveys and those who did not) was analyzed using Pearson's Chi-square test to assess if the non-completion behavior was associated with any significant differences on the demographic

variables included in the IAP model (i.e., age, educational attainment, career moves). The results were non-significant on the demographic variables in the logistic regression model. Subject taught, while not a model variable, did vary significantly ($p = 0.012$). This is understandable given the majority of participants ($n = 62$) attended workshops segregated by subject taught and the server overload event occurred during a workshop for English/Language Arts teachers.

Innovativeness. Table 4 reports the descriptive statistics for the responses to the Innovativeness Scale (IS) (Hurt, Joseph, & Cook, 1977) and the Perceived Organizational Innovativeness Scale (PORGI) (Hurt & Teigen, 1977). A five-point Likert scale ranging from one (strongly disagree) to five (strongly agree) was used in both surveys. The IS was scored using an algorithm that results in a raw score between 12 and 84, and the PORGI was scored using an algorithm that results in a raw score between 25 and 125 (McCroskey, 2006a, 2006b). For both surveys, the minimum raw score was higher than the theoretical minimum while the maximum raw score equaled the theoretical maximum. This is an indicator that participants are more, rather than less, innovative and thereby more likely to adopt an innovation.

Table 4

Raw Score Descriptive Statistics for the Innovativeness Scale (Hurt, Joseph, & Cook, 1977) and Perceived Organizational Innovativeness Scale (Hurt & Teigen, 1977)

	Innovativeness Scale (IS)	Perceived Organizational Innovativeness Scale (PORGI)
N	105	99
Minimum raw score	38	64
Maximum raw score	84	125
Mean raw score	63.02	97.01
Standard deviation	8.39	11.87

The IS and the PORGI produce raw scores as reported in Table 4. Additionally, both scales include a scoring procedure[3] that uses a respondent's raw score to place him or her into one of Rogers' (2003) five adopter categories (i.e., Innovator, Early Adopter, Early Majority, Late Majority, Laggard). Rogers developed the adopter categories as a "means of convenience in describing the members of a system" (p. 267). The more innovative an individual is, the earlier he or she adopt an innovation as compared to his or her peers. The categorization of participants' IS raw scores and PORGI scores are presented in Table 5. Categorization of IS raw scores resulted in 22% of participants being categorized as Innovators or Early Adopters, 59% categorized in the Early Majority group, and 18% in either the Late Majority or Laggards group. (McCroskey, 2006b; Rogers, 2003). The categorization of participants' PORGI scores resulted in 77% of

[3] See Appendix B for the IS scoring procedures and Appendix C for the PORGI scoring procedures (McCroskey, 2006a, 2006b).

participants placing their school in the Innovator or Early Adopter category, 22% in the Early Majority, 1% in the Late Majority, and no participant perceived his or her school in the Laggard category. The categorization of participants' IS and PORGI raw scores indicates that participants considered themselves to be more innovative rather than less and perceived their schools to be more innovative then they were individually.

Table 5

Percentages of Participants in Each Adopter Category Based on Innovativeness Scale (Hurt, Joseph, & Cook, 1977) and Perceived Organizational Innovativeness Scale (Hurt & Teigen, 1977) Raw Scores

	Innovativeness Scale (IS) (n = 105)	Perceived Organizational Innovativeness Scale (PORGI) (n = 99)
Innovativeness category	Percent (%)	Percent (%)
Innovator	1.90	11.11
Early Adopter	20.00	65.66
Early Majority	60.00	22.22
Late Majority	15.24	1.01
Laggard	2.86	0.00

While participants considered themselves and their schools to be innovative, without a comparison to the general population of secondary school teachers it is difficult to ascertain whether or not those perceptions differ from the population in any important ways. Rogers (2003), when he synthesized the adopter categories, also generated a theoretically expected distribution of the general population of individuals and

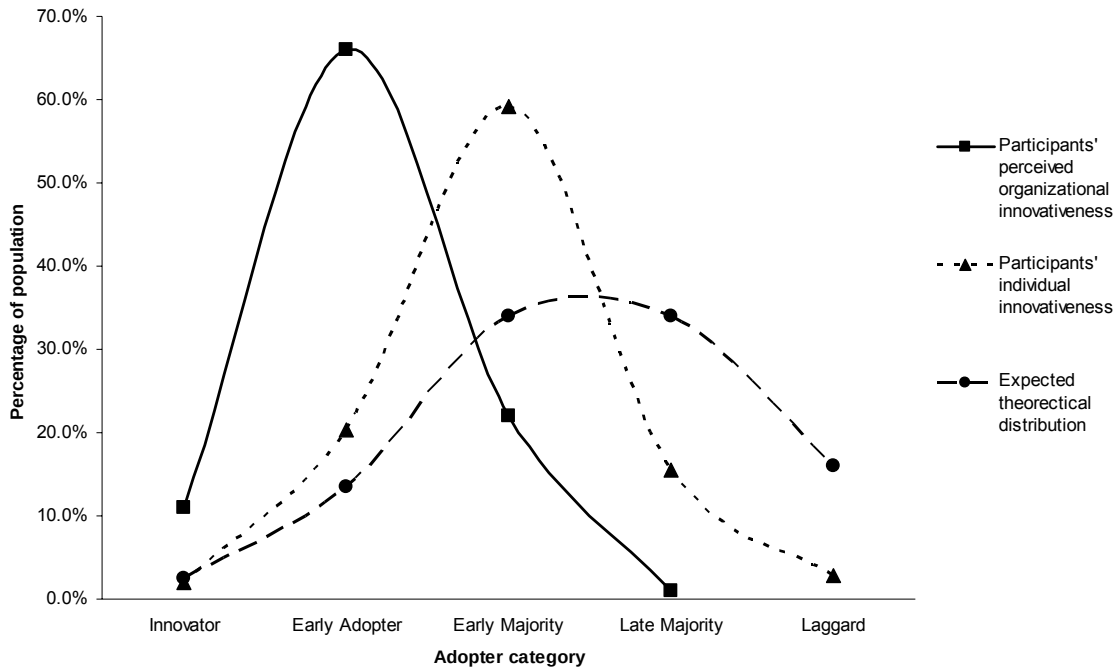
organizations across those categories. He calculated the distribution based on the assumption that "adopter distributions follow a bell-shaped curve over time and approach normality" (p. 275). Rogers' states that the theoretical distribution of both individuals and organizations are the same, and that in any given population of individuals or organizations 2.5% can be classified as Innovators, 13.5% as Early Adopters, 34% in the Early Majority, 34% in the Late Majority, and 16% as Laggards (p. 281). Figure 2 illustrates the comparison between Rogers' theoretically expected distribution of individuals and organizations across adopter categories and the distribution of participants based on the categorization of their IS (i.e., individual innovativeness) (Hurt, Joseph, & Cook, 1977)and PORGI (i.e., perceived organizational innovativeness) (Hurt & Teigen, 1977) raw scores.

The results of the comparison are, for individual innovativeness, while the percentage of Innovators among participants is approximately the same as the theoretical distribution, there is a higher percentage of participants in both the Early Adopter and Early Majority categories than Rogers (2003) states should theoretically be expected. Correspondingly, there is a lower percentage of participants in the Late Majority and Laggard categories than should theoretically be expected. The comparison indicates that the population in this study is more likely to adopt innovations earlier than the general population because 82% of the participants placed themselves in one of the three earliest adopting categories as compared to the 50% that was theoretically expected. For perceived organizational innovativeness, the percentage of participants who perceived their school as among the Innovators was more than four times greater than the theoretical distribution (11% vs. 2.5%) and the majority of participants perceived their

school as an Early Adopter. Thus, nearly 77% of participants perceived their school in the two most innovative groups as compared to 16% in the theoretical distribution. The comparison indicates that participants perceived their school as being a great deal more innovative than theoretically expected. This means that their schools were much more likely to adopt innovations earlier than organizations in the general population. This result was expected given the district's early adoption of laptops for all students and teachers and the national recognition they have earned for the innovativeness of their programs overall.

Figure 8

Percentage Distribution of Participants' Individual Innovativeness and Perceived Organizational Innovativeness Across Adopter Categories Compared With Expected Theoretical Distribution



Perceived Characteristics of Innovative Scale (PCIS). Responses to the PCIS (D. R. Compeau & Meister, 2003) are summarized in Table 6. The 63 participants who completed the PCIS answered 34 questions assessing their perceptions of 10 perceived characteristics of the RepliGo™ software (i.e., relative advantage, compatibility with current work practice, compatibility with preferred work style, compatibility with prior experience, compatibility with values, ease of use, image, communicability, measurability, and trialability). A seven-point Likert scale ranging from one (strongly disagree) to five (strongly agree) was used. Unlike the IS (Hurt, Joseph, & Cook, 1977) and PORGI (Hurt & Teigen, 1977) scales where a raw score is calculated, the PCIS

scoring procedure results in a mean of the responses to the items for each perceived characteristic (D. R. Compeau & Meister, 2003). Each mean is a subscale and included in the logistic regression analysis as a predictor factor. Table 6 displays the number of items for each perceived characteristic that made up the mean score for that characteristic and the descriptive statistics.

Theoretically, the full range of responses for each PCIS (D. R. Compeau & Meister, 2003) subscale is a mean between 1.00 and 7.00. For example, a response of "strongly disagree" on each of the five items in the relative advantage subscale results in a subscale mean of 1.00. Likewise, a response of "strongly agree" on each item in the same subscale results in a subscale mean of 7.00. Four PCIS constructs (compatibility with current work practice, compatibility with preferred work style, compatibility with prior experience, and measurability) all had lowest individual means of 1.00 and highest individual means of 7.00, matching the theoretical range of responses. This range of responses indicates that the full range of agreement and disagreement was present for those four PCIS subscales. However, five PCIS constructs (relative advantage, compatibility with values, ease of use, communicability, and trialability) all had lowest individual means greater than 1.00 and highest individual means of 7.00. This narrower and higher range of responses indicates that overall, participants agreed with the items in these subscales more than if the full range of responses was present. Finally, image was the only subscale where the highest individual mean was less than seven, indicating that, overall, participants disagreed with the items in this subscale more than if the full range of responses was present. The importance of this result can be illustrated by examining the descriptive statistics for the communicability subscale. The communicability

construct is defined as “the degree to which the results of using the innovation can be easily communicated to others” (D. R. Compeau & Meister, 2003, p. 39). With a lowest individual mean of 3.50, a highest individual mean of 7.0,and a group mean of 5.34, the participants overall agreed that they could easily communicate the results of using RepliGo™.

Table 6

Number of Items and Descriptive Statistics for the Perceived Characteristics of Innovating Scale (D. R. Compeau & Meister, 2003) (N = 62)

		Mean score for each characteristic			
Perceived characteristic of the innovation	Number of items	Lowest individual mean	Highest individual mean	Group mean	Standard deviation
Relative advantage	7	1.43	7.00	4.89	1.15
Compatibility with current work practice	2	1.00	7.00	4.60	1.46
Compatibility with preferred work style	1	1.00	7.00	4.60	1.58
Compatibility with prior experience	2	1.00	7.00	4.25	1.49
Compatibility with values	3	3.67	7.00	5.69	1.07
Ease of use	5	2.00	7.00	4.94	1.06
Image	5	1.00	6.60	4.18	1.37
Communicability	2	3.50	7.00	5.34	0.89
Measurability	3	1.00	7.00	4.51	1.12
Trialability	4	2.50	7.00	4.98	1.07

Dependent variable (field trial participation). As stated previously, the dependent variable response was the last response gathered from participants at each workshop. Participants were asked whether or not they would participate in a field trial of the RepliGo™ software in their classroom. The question was presented as an invitation to participate, and participants could choose either "No, I decline to participate in the field trial" or "Yes, I will be participating in the field trial." Responses from the 68 participants

who responded indicate that the two groups (i.e., decliners and acceptors) are nearly equal with 49% (n = 33) declining to participate and 51% (n = 35) accepting the invitation to participate in the field trial of RepliGo™.

Reliability of the scales. Once the descriptive statistics for each survey were determined, the reliability of the IS, PORGI, and PCIS was calculated. Reliability of these surveys for all respondents was assessed using Cronbach's alpha. Table 7 displays the results by scale and responder group for the IS, the PORGI, and each of the PCIS subscales. The groups are (a) all respondents for the particular survey or subscale, and (b) respondents whose data were included in the regression analysis. The second group includes the data from the six participants who did not complete the PORGI, which was dropped from the model as mentioned above, and thereby allowed their data to be included in the analysis. Also displayed are the reliability coefficients reported in the literature. The reliability results for this study are comparable to those found in prior studies (D. R. Compeau & Meister, 2003; Hurt, Joseph, & Cook, 1977; Hurt & Teigen, 1977; Pallister & Foxall, 1998; Simonson, 2000) except for three of the PCIS subscales (compatibility with current work practices, compatibility with prior experience, and trialability). These three PCIS subscales were below what was reported by Compeau and Meister (2003) using an internal consistency reliability test, but two of these, compatibility with current work practices and trialability, had alphas above 0.70, the level of acceptability used in this study. The alpha for the compatibility with prior experience subscale was 0.68, and therefore this predictor was dropped from the regression analysis.

Table 7

Reliability of Scales by Responder Group Compared to Reliability Reported in the Literature.

Scale or Subscale	Number of items	For all respondents		For respondents included in regression analysis (n=61)	Reliability reported in the literature
		n	Cronbach's Alpha		
Innovativeness Scale (IS)	20	105	0.86	0.85	0.86-0.90[a]
Perceived Organizational Innovativeness Scale (PORGI)	25	99	0.93	–[b]	0.95-0.98[c]
Perceived Characteristics of Innovating Scale (PCIS)					
Reliability	7	62	0.95	0.95	0.95[d]
Compatibility with current work practices	2	62	0.78	0.77	0.88
Compatibility with preferred work style	1	62	–[e]	–	–
Compatibility with prior experience	2	62	0.68	–[f]	0.80
Compatibility with values	3	62	0.81	0.81	0.82
Ease of use	5	62	0.85	0.85	0.89
Image	5	62	0.94	0.94	0.85
Communicability	2	62	0.89	0.89	0.82
Measurability	3	62	0.83	0.83	0.82
Trialability	4	61	0.77	0.76	0.88

[a]Range for alpha reported in Hurt, Joseph & Cook (1977), Hurt & Teigen (1977), Pallister & Foxall (1998), Simonson (2000)
[b]For this popululation, PORGI data were found not to be correlated with the dependent variable and were not included in the regression
[c]Range for alpha reported in Hurt & Teigen (1977), Simonson (2000)
[d]Internal Consistency Reliabiltiy (ICR) for all subscales reported in Compeau & Meister (2003)
[e]The compatibility with preferred work style subscale has one question, thereby no reliability estimate was able to be calculated.
[f]Reliability was 0.68 and not ≥ 0.70, therefore the factor was dropped from the regression analysis.

Logistic regression analysis. The IAP model examined in this study used participants' response to the invitation to participate in the field trial of the RepliGo™ software as a dichotomous dependent variable in a logistic regression analysis. Fifteen predictive factors were included in the IAP model. Data on these predictive factors were gathered using four surveys as described above. Figure 9 displays the 15-factor equation for the logistic regression.

$$\ln\left(\frac{\pi}{1-\pi}\right) = \alpha + \beta_1\chi_1 + \beta_2\chi_2 + \ldots + \beta_{15}\chi_{15}$$ [4]

Figure 9. Equation for a 15-factor logistic regression analysis

While the number of cases available for analysis (n = 56) was too small to adequately fit the 15-factor model, the data were examined in preparation for an initial logistic regression analysis (DeMaris, 1995) using SPSS. The preparatory examination of the data consisted of tests for normality, homoscedasticity, correlation, multicollinearity, and identification of outliers. While normality of the data is not required to perform a logistic regression analysis, it was deemed wise to examine the data for normality regardless. To determine normality, a plot of the distribution of responses for each predictor variable was examined. Second, the data were checked for homoscedasticity by examining the classification table from a logistic regression analysis as suggested by Garson (2006c). The data exhibited normality and did not violate the homoscedasticity assumptions. Third, a test for correlation was performed to determine the significance, direction, and strength of the degree of correlation between the predictor factors and the dependent variable and the degree of correlation among the predictive factors.

The Pearson r results for the test for correlation and the significance level for all variables in the IAP model are displayed in Table 8. The correlation results indicate that, for this sample, of the 15 predictors in the model, 11 are significantly correlated ($p < .05$) with the participant's choice to accept or decline the invitation to participate in the field trial of RepliGo™. The variables that do not reach significant levels of correlation are the three demographic variables (i.e., age group, educational attainment, and career moves)

[4] The error term is represented by α and each predictor variable is represented by the expression $\beta_x\chi_x$.

and perceived organizational innovativeness. The remaining factors have correlations with the dependent variable that are positive and ranged from moderate (r = .295) to strong (r = .647). The correlation results also indicate weak to moderate correlations between the remaining factors.

The correlation results are not surprising from a theoretical viewpoint. While age group, educational attainment, and career moves were mentioned as proxies for individual innovativeness in Tornatzky and Fleischer (1990), two of the three studies they cite predate the publication of the IS (Hurt, Joseph, & Cook, 1977). The IS allows a more direct measure of the innovativeness construct and one that has been more thoroughly replicated, thereby reducing the need to rely on proxies. Hence, in the interest of parsimony, the demographic predictors (i.e., age group, educational attainment, and career moves) were dropped from the IAP model in favor of relying solely on the IS.

The non-correlation of participants' PORGI (Hurt & Teigen, 1977) score (r = .016, p = .906) with their intention to participate in the field trial of RepliGo™, while unwelcome, is not surprising. Hurt and Teigen (1977) found that perceived organizational innovativeness, when coupled with individual innovativeness, was a predictor of participation in the innovation-decision *process*, but the role of perceived organizational innovativeness in predicting innovation *adoption* was not claimed. This means individuals with high IS and PORGI scores are more likely to consider an innovation, but a high PORGI score is not an indicator they will adopt any particular innovation being considered.

It is concluded from this study that perceived organizational innovativeness was not a predictor of participation in the field trial of RepliGo™ and the construct was

dropped as a predictor from both the IAP model and the regression analysis. A consequence of dropping perceived organizational innovativeness as a predictor from the IAP model was that data from six participants could be added to the regression analysis, raising the total number of participants to 61. This was possible because these six participants completed all IAP surveys except the PORGI.

After dropping the variables mentioned above (age, educational attainment, number of career moves, and perceived organizational innovativeness), the revised model had 10 predictor variables. These are individual innovativeness, relative advantage, compatibility with current work practice, compatibility with preferred work style, compatibility with values, ease of use, image, communicability, measurability, and trialability.

Table 8

Correlations Between IAP Model Variables (Listwise, N = 54)

Variable		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Age Group	Pearson Correlation	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Sig. (2-tailed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2. Educational attainment	Pearson Correlation	.17	–	–	–	–	–	–	–	–	–	–	–	–	–
	Sig. (2-tailed)	.21	–	–	–	–	–	–	–	–	–	–	–	–	–
3. Career moves	Pearson Correlation	.14	.04	–	–	–	–	–	–	–	–	–	–	–	–
	Sig. (2-tailed)	.30	.79	–	–	–	–	–	–	–	–	–	–	–	–
4. Individual innovativeness	Pearson Correlation	-.26	-.13	-.07	–	–	–	–	–	–	–	–	–	–	–
	Sig. (2-tailed)	.06	.35	.58	–	–	–	–	–	–	–	–	–	–	–
5. Perceived organizational innovativeness	Pearson Correlation	.25	.08	-.05	.04	–	–	–	–	–	–	–	–	–	–
	Sig. (2-tailed)	.07	.56	.74	.79	–	–	–	–	–	–	–	–	–	–
6. Relative advantage	Pearson Correlation	-.08	-.38**	.21	.41**	.31*	–	–	–	–	–	–	–	–	–
	Sig. (2-tailed)	.55	.01	.13	.00	.02	–	–	–	–	–	–	–	–	–
7. Compatibility w/current work practice	Pearson Correlation	-.12	-.21	.07	.54**	.20	.71**	–	–	–	–	–	–	–	–
	Sig. (2-tailed)	.38	.12	.63	.00	.14	.00	–	–	–	–	–	–	–	–
8. Compatibility w/preferred work style	Pearson Correlation	-.06	-.15	.15	.57**	.38*	.68**	.77**	–	–	–	–	–	–	–
	Sig. (2-tailed)	.68	.29	.28	.00	.02	.00	.00	–	–	–	–	–	–	–
9. Compatibility w/values	Pearson Correlation	-.08	.13	.01	.48**	.22	.43**	.47**	.50**	–	–	–	–	–	–
	Sig. (2-tailed)	.59	.34	.98	.00	.11	.00	.00	.00	–	–	–	–	–	–
10. Ease of use	Pearson Correlation	-.14	-.23	-.01	.59**	.33*	.75**	.70**	.67**	.57**	–	–	–	–	–
	Sig. (2-tailed)	.33	.09	.92	.00	.02	.00	.00	.00	.00	–	–	–	–	–
11. Image	Pearson Correlation	-.06	-.29*	.04	.31*	.07	.53**	.41**	.42**	.16	.38**	–	–	–	–
	Sig. (2-tailed)	.67	.04	.79	.02	.60	.00	.00	.00	.25	.00	–	–	–	–
12. Communicability	Pearson Correlation	-.19	-.09	.11	.62**	.06	.58**	.43**	.57**	.6**	.62**	.24	–	–	–
	Sig. (2-tailed)	.17	.53	.44	.00	.69	.00	.00	.00	.00	.00	.09	–	–	–
13. Measurability	Pearson Correlation	.02	-.14	.18	.39**	.18	.56**	.42**	.37**	.41**	.38**	.22	.49**	–	–
	Sig. (2-tailed)	.88	.30	.19	.00	.19	.00	.00	.01	.00	.00	.10	.00	–	–
14. Trialability	Pearson Correlation	.04	.19	-.00	.38**	.34*	.32*	.30*	.40**	.43**	.43**	.10	.37**	.22	–
	Sig. (2-tailed)	.76	.16	.98	.00	.01	.02	.03	.00	.00	.00	.48	.01	.11	–
15. Field trail participation (dependent variable)	Pearson Correlation	-.21	-.13	.18	.35**	.02	.60**	.65**	.52**	.52**	.51**	.30*	.51**	.31*	.35*
	Sig. (2-tailed)	.13	.34	.19	.01	.91	.00	.00	.00	.00	.00	.03	.00	.02	.01

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

After revising the IAP model by dropping the three demographic proxies for individual innovativeness, the perceived organizational construct, and the compatibility with prior experience construct, the correlations between predictor factors were examined to determine if multicollinearity existed. Garson (2006b) states that multicollinearity is the "intercorrelation of independent variables", and, when this problem occurs, it makes the assessment of the unique role of each affected predictor variable difficult or impossible. Tolerance values were used to indicate multicollinearity and a cutoff value of .20 was selected as the minimum acceptable value (Garson, 2006a). As all predictors in the revised IAP model had tolerance values above .20, it was determined that no multicollinearity problem existed in the data.

The data were then examined for the presence of outliers. A logistic regression analysis including the 10 remaining predictive factors was performed and the standardized residual was saved. While considered highly arbitrary, Garson's (2006c) rule of thumb for the identification of outliers was used. Garson's rule of thumb states that individuals with standardized residuals outside the acceptable range (-1.96 to 1.96) can be considered as outlier candidates and should be removed when a substantial reason can be identified (Garson, 2006c). The standardized residuals for the five participants who completed their surveys in the weeks following the August workshop were examined and these fell within the acceptable range. Two other participants had standardized residuals that were outside the acceptable range. One individual had a standardized residual of 3.15, but an examination of his data did not reveal a substantial reason for removing them from the analysis. The second individual's standardized residual was -6.40 and an examination of their data identified them as the individual who

completed all surveys but did not provide their response to the dependent variable during the workshop. This was the participant who was interviewed the day after their workshop and provided his dependent variable response at that time. This individual had overnight to consider their choice to participate or not in the field trial, something no other participant was provided. Given this unique condition, it was determined that this individual was an outlier and his data were removed from the analysis.

The removal of the outlier meant that data from 60 cases (i.e., participants) were available for the logistic regression analysis. The rule of thumb for logistic regression analysis is to have a sample size of between 10 and 20 cases per predictor variable (Garson, 2006c). Applying this rule, a ten-factor model such as the revised IAP model would need a sample of 100-200 cases to produce stable results (i.e.. results that will bear replication of the analysis). When results are unstable, individual predictors in the model may appear to be stronger predictors of the dependent variable than they would be in a stable model. Thereby, the number of cases (N=60) available in this study necessitated a reduction in the number of predictive factors to reach a stable model. An iterative factor reduction process was undertaken to reach a stable model. Results from previous studies that examined the role of the PCIs as predictive factors were consulted to identify likely candidates for inclusion in the reduced models. Five models were examined, beginning with Model 1 (i.e., the 10-factor revised IAP model). Table 9 displays a summary of the five models as a guide to the iterative process. Each model is also presented separately as part of the narrative describing the results of each analysis.

Table 9

Summary of the Five Logistic Regression Models

Variable	Logistic regression model[a]									
	1.		2.		3.		4.		5.	
	Wald	Exp(B)	Wald	Exp(B)	Wald	Exp(B)	Wald	Exp(B)	Wald	Exp(B)
Age group		—		—		—		—		—
Educational attainment		—		—		—		—		—
Career moves		—		—		—		—		—
Individual innovativeness	0.004	1.005		—		—		—		—
Perceived organizational innovativeness		—		—		—		—		—
Relative advantage	2.345	3.873	2.597	3.798	3.866	3.179	1.381	1.960	5.033*	3.243
Compatibility w/current work practice	6.195*	17.254	6.201*	17.22	7.733**	4.357	8.279**	5.536	8.417**	5.066
Compatibility w/preferred work style	1.318	0.38	1.315	0.382		—		—		—
Compatibility w/values	1.46	2.321	1.458	2.318		—		—		—
Ease of use	0.902	0.392	0.957	0.399	0.033	1.113		—		—
Image	0.354	1.387	0.377	1.395		—		—		—
Communicability	2.563	5.089	2.684	5.147		—	3.669	3.922		—
Measurability	1.242	0.417	1.286	0.422		—		—		—
Trialability	1.874	2.8	1.888	2.786		—		—	3.813	2.812

[a]All model chi-squares are significant at $p < .001$

*$p < .05$ **$p < .01$

Table 10 displays the results of the logistic regression analysis for Model 1, the revised 10-factor IAP model after the outlier had been removed. The predictor factors in the model were individual innovativeness, relative advantage, compatibility with current work practice, compatibility with preferred work style, compatibility with values, ease of use, image, communicability, measurability, and trialability. As mentioned earlier, this model is unstable due to sample size (n = 60). However, the results supported the goodness-of-fit of the entire model with the data (Nagelkerke R square = .779) and the omnibus test of the model coefficients was highly significant ($\chi^2 = 52.495$, $p < .001$). Additionally, this model correctly predicts 90% of the participants' intention to participate or not participate in the field trial as compared to 53% for the null model. While Model 1 is unstable, an examination of the results yielded information on two individual predictor variables worth noting.

Table 10

Predicted Probability of Field Trial Participation – Model 1

Overall model						
Omnibus χ^2	52.495**					
Nagelkerke R^2	0.779					
Percentage Correct (%)	90.0					
Predictors	*B*	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*
Individual Innovativeness	0.005	0.078	0.004	1	0.950	1.005
Relative Advantage	1.354	0.884	2.345	1	0.126	3.873
Compatibility with current work practice	2.848	1.144	6.195	1	0.013	17.254
Compatibility with preferred work style	-0.969	0.844	1.318	1	0.251	0.380
Compatibility with values	0.842	0.697	1.460	1	0.227	2.321
Ease of use	-0.937	0.987	0.902	1	0.342	0.392
Image	0.327	0.550	0.354	1	0.552	1.387
Communicability	1.627	1.016	2.563	1	0.109	5.089
Measurability	-0.874	0.784	1.242	1	0.265	0.417
Trialability	1.030	0.752	1.874	1	0.171	2.800

**$p < .01$

First, one of the Model 1 predictor variables, *compatibility with current work practice*, is a highly significant predictor of participants' intention to participate in the field trial (*Wald* = 6.195, p = .013). Further, compatibility with current work practice has an odds ratio (*Exp(B)*) of 17.254, indicating that for every one-unit increase in the mean of this subscale with all other factors held constant, the likelihood of participating in the field trial of RepliGo™ increases by a factor of 17.254 times. This is a large effect and

means the more participants perceived RepliGo™ as compatible with their current teaching practice, the more likely they were to indicate they would be participating in the field trial. Thereby, while Model 1 is unstable, compatibility with current work practice should be included in the logistic regression analysis of subsequent revised models. This finding is supported given that compatibility was indicated as one of the major predictors of innovation adoption in the meta-analysis of 75 PCI-based research studies by Tornatzky and Klein (Tornatzky & Klein, 1982) and in studies cited by Rogers (2003).

Second, in Model 1 *individual innovativeness* is indicated as independent of participants' intention to participate in the field trial of RepliGo™ because the *Wald* statistic is close to zero (*Wald* = 0.004) and the *Exp(B)* is very close to 1 (*Exp(B)* = 1.005). As stated earlier, the *Exp(B)* statistic is the odds ratio and, when a one-unit increase in the predictor (i.e., a one-unit increase in a participants' IS raw score) is multiplied by *Exp(B)*, *Exp(B)* indicates the increase in the likelihood of occurrence of the dependent event (i.e., accepting the invitation to participate in the field trial). In the case of individual innovativeness, *Exp(B)* = 1.005, thus there is no predictive link between participants' IS score and their decision to participate in the field trial of RepliGo™. To test the independence of individual innovativeness from participants' intention to participate in the field trial of RepliGo™, a logistic regression analysis of Model 2 (i.e., a nine-factor model without individual innovativeness) was performed to determine if the overall predictive power of Model 2 was different from Model 1. Table 11 displays the results of the analysis of Model 2.

Table 11

Predicted Probability of Field Trial Participation – Model 2

Overall model						
Omnibus χ^2	52.491					
Nagelkerke R^2	0.779					
Percentage Correct (%)	90.0					
	B	S.E.	Wald	df	Sig.	Exp(B)
Relative Advantage	1.335	0.828	2.597	1	0.107	3.798
Compatibility with current work practice	2.846	1.143	6.201	1	0.013	17.220
Compatibility with preferred work style	-0.963	0.840	1.315	1	0.252	0.382
Compatibility with values	0.841	0.696	1.458	1	0.227	2.318
Ease of use	-0.918	0.938	0.957	1	0.328	0.399
Image	0.333	0.542	0.377	1	0.539	1.395
Communicability	1.638	1.000	2.684	1	0.101	5.147
Measurability	-0.862	0.760	1.286	1	0.257	0.422
Trialability	1.025	0.746	1.888	1	0.169	2.786

The overall percentage of correct predictions remained at 90.0% and the omnibus test of the model coefficients was nearly the same ($\chi^2 = 52.491$, $p < .001$). Thus it was concluded that individual innovativeness did not play a role in this population's intention to participate in the field trial of RepliGo™. This finding means that, for this study, including measures of innovativeness, individual or perceived organizational, did not enhance the strength of the IAP model beyond the models proposed by Moore and Benbasat (1991) and Compeau and Meister (2003) that rely solely on the perceived characteristics of the innovation constructs. While unexpected, given that participants'

innovativeness and perceived organizational innovativeness varied greatly from Rogers' (2003) theoretically expected values for the general population, it is possible that these constructs could be factors in other populations considering the same or different innovations. It is also possible that one or both of these constructs play a role in later stages of implementation.

Models 3, 4, and 5. Next, an examination of the nine predictive factors was undertaken to determine if a theoretically sound model could be supported by the data, given the limited size of the sample. As the remaining factors were all perceived characteristics of the innovation, Tornatzky and Klein's meta-analysis (1982) of 75 innovation diffusion studies and Rogers (2003) were used as guides. Rogers states that relative advantage and compatibility are "particularly important" (p. 17) in explaining adoption while Tornatzky and Klein found that relative advantage, compatibility, and complexity (the precursor to ease of use) "had the most consistent significant relationships to innovation adoption" (p. 28). Thus, Model 3 consisted of relative advantage, compatibility with current work practice, and ease of use as the predictor variables. Model 3 had the advantage of using three predictor variables, a number that followed Garson's (2006b) rule of thumb to avoid instability. Table 12 displays the results of this analysis. The results support the significance of compatibility with current work practice (*Wald* = 7.733, p = 0.005) and relative advantage is found to be significant (*Wald* = 3.866, p = 0.049), but ease of use is not found to be significant (*Wald* = 0.033, p = 0.856). Additionally, the odds ratio for ease of use is sufficiently close to 1.0 (*Exp(B)* = 1.113) that this variable was found to be independent of the dependent variable and thereby found not to be a predictor of the dependent variable.

Table 12

Predicted Probability of Field Trial Participation – Model 3

Overall model					
Omnibus χ^2	41.126**				
Nagelkerke R^2	0.663				
Percentage Correct (%)	81.700				
Predictors	*B*	*S.E.*	*Wald*	*Sig.*	*Exp(B)*
Relative advantage	1.157	0.588	3.866	0.049	3.179
Compatibility with current work practice	1.472	0.529	7.733	0.005	4.357
Ease of use	0.107	0.590	0.033	0.856	1.113

$^{**}p < .01$

The finding that ease of use is not a significant predictor for intention to participate in the field trial of RepliGo™, while contrary to most DOI research, is supported by two recent studies of web-based innovations (Carter & Belanger, 2003; Jebeile & Reeve, 2003). This result for the ease of use construct was unexpected by Carter and Bellanger, and they attributed it to participants' prior experience with computers and participants' confidence in using web-based services. They concluded that participants' comfort with using a computer significantly reduced the potential complexity of web-based services. Similarly, participants in this study were all experienced computer users, and it is concluded that this comfort with using a computer significantly reduced the potential complexity of RepliGo™ for this population and thereby increased their perceptions of ease of use. However, without a comparison to a

population less experienced with computers, it is not possible to conclude that the reported ease of use was not attributable, at least in part, to the design of the RepliGo™ software.

Once the analysis of Model 3 was completed, Model 2 displayed in Table 11 was examined further. Six other predictor factors were found to be non-significant, but this could be due in part to the instability of the nine-factor model. These factors were compatibility with preferred work style, compatibility with values, image, communicability, measurability, and trialability. Jebeile and Reeve (2003) was examined because their study was similar to the present study in population (high school teachers), sample size (n = 75), and research objective (providing a framework for school leaders to consider when formulating diffusion plans). Trialability was a significant predictor ($p < .01$) in their multiple regression analysis of seven factors predicting the adoption of web-based lesson planning resources. Likewise, results demonstrability, the precursor of communicability, was a significant predictor ($p <. 01$) in their multiple regression analysis of the adoption of web-based lesson delivery by the same participants. With Jebeile and Reeve as a guide, Model 4 and Model 5 were created with relative advantage, and compatibility of current work practice in both models and communicability as a third factor in Model 4, and trialability as a third factor in Model 5. The results of the logistic regression analyses are displayed in Table 13 for Model 4 and Table 14 for Model 5.

Table 13

Predicted Probability of Field Trial Participation – Model 4

Overall model					
Omnibus χ^2	45.457**				
Nagelkerke R^2	0.709				
Percentage Correct (%)	88.300				
Predictors	*B*	*S.E.*	*Wald*	*Sig.*	*Exp(B)*
Relative advantage	0.673	0.573	1.381	0.240	1.960
Compatibility with current work practice	1.711	0.595	8.279	0.004	5.536
Communicability	1.367	0.713	3.669	0.055	3.922

**$p < .01$

Table 13 displays the results of the logistic regression analysis with communicability as the third factor. The results are that the model was highly significant ($\chi^2 = 45.457$, $p < .001$) and had adequate goodness-of-fit with the data (Nagelkerke $R^2 = .709$). For the predictors in the model, current work practice remains a significant factor (*Wald* = 8.279, p = 0.004), but relative advantage is not significant (*Wald* = 1.381, p = 0.240), and communicability is marginally significant (*Wald* = 3.669, p = 0.055).

Table 14

Predicted Probability of Field Trial Participation – Model 5

Overall model					
Omnibus χ^2	45.642**				
Nagelkerke R^2	0.711				
Percentage Correct (%)	88.300				
Predictors	*B*	*S.E.*	*Wald*	*Sig.*	*Exp(B)*
Relative advantage	1.176	0.524	5.033	0.025	3.243
Compatibility with current work practice	1.622	0.559	8.417	0.004	5.066
Trialability	1.034	0.529	3.813	0.051	2.812

$^{**}p < .01$

Table 14 displays the results of the logistic regression analysis with trialability as the third factor. The results are that the model is highly significant ($\chi^2 = 45.642$, $p < .001$) and has slightly improved goodness-of-fit with the data (Nagelkerke $R^2 = .711$) compared to the model that included communicability (Model 4). For the predictors in the model, compatibility with current work practice remains a significant factor (*Wald* = 8.417, p = 0.004), as does relative advantage (*Wald* = 5.033, p = 0.025), while trialability is marginally significant (*Wald* = 3.813, p = 0.051). When comparing the results of these two regression analyses, the three-factor model of compatibility with current work practice, relative advantage, and trialability is found superior to the three-factor model of compatibility with current work practice, relative advantage, and communicability because all three factors are found to be significant or marginally significant and the

standard errors are lower for each of the factors when compared to the model with communicability.

Summary of the analysis of the quantitative data. While the number of participants who provided usable quantitative data was significantly lower than expected, the analysis of the quantitative data supported these conclusions about this sample: (a) participants' individual innovativeness was greater than what was theoretically expected; (b) participants perceived their schools to be a great deal more innovative than theoretically expected; (c) the inclusion of measures of innovativeness in the IAP, whether they were proxies for innovativeness (i.e., age, educational attainment, career moves) or self-report measures of innovativeness (i.e. the IS, the PORGI), were not supported; (d) participants' perceptions of the compatibility of RepliGo™ with their current work practice was a major predictor of their intention to participate in the field trial of RepliGo™; (e) in a reduced model, participants who perceived RepliGo™ as having relative advantage over their present practice were significantly more likely to participate in the field trial; and (f) in a small model, trialability was found to be a marginally significant predictor of participants' intention to participate in the field trial of RepliGo™.

Follow-up interviews. Follow-up interviews were performed after the April and May workshops and participants were requested to leave a voicemail or email message in response to a written prompt after the August workshops. The purpose for collecting these data was two-fold. First, it was deemed necessary to triangulate participants' survey responses. Second, as noted earlier, DOI research has generally been a quantitative enterprise, and there have been calls to remedy that by including qualitative data in the

analysis (Meyer, 2004). The argument for including qualitative data in DOI research is to expand what is known about participants' perceptions of an innovation beyond what can be learned from their responses to a multiple-response survey (Meyer, 2004).

Data were gathered from a convenience sample of 24.5% (n = 26) of the 106 participants using an in-person interview, a voicemail response to a written prompt, or an email response to a written prompt. The majority of these participants (n = 18) provided face-to-face interviews following the workshops in late April and early May. Seven participants left voicemail messages and one participant responded via email following the August workshops. All of these were one-time responses; no additional contact was made. In keeping with the point-of-adoption design used in this study, the time span between the workshops and the follow-up interviews, voicemails and emails was monitored to avoid recall problems (Meyer, 2004).

Overall, the time span between the workshop and the interview, voicemail, or email was less than eight days. Twelve of the interviews occurred within two days of the participant's workshop. The time span for the other four interviews was between six and eight days. The email message received seven days after the August workshop was included in the analysis. Five of the voicemail messages were recorded within the week following the August workshops, and four of those were recorded within two days of the workshop. Two voicemail messages received more than two weeks after the August workshop were not included in the analysis. Data from one interview and two voicemails were removed from the analysis because the participants did not complete the PCIS, making triangulation impossible. One voicemail message did not yield usable data. The remaining 20 interviews were analyzed.

Interviews and voicemail responses had a considerable range in duration. The briefest interview was 1 minute, 46 seconds, and the longest was 16 minutes, 45 seconds. Voicemail responses were uniformly brief, ranging in duration from 32 seconds to 1 minute, 16 seconds. The email response was similar in length to a brief voicemail response (55 words). When asked to confirm their choice regarding their participation in the field trial of RepliGo™, all participants responded identically to their survey response, except for the one participant who had not provided a survey response and became the outlier in the logistic regression analysis.

Interviews and voicemails were transcribed and content analysis was performed on the transcriptions using NVivo™ software. Each transcript was coded to identify the perceived characteristic of the innovation (PCI) construct described, and then each of these descriptions was examined to determine the direction of the perception (i.e., positive or negative) and whether it was unique or a repetition of a PCI that appeared elsewhere in the same transcript. The PCI codes used, their definitions, and the number of the times each code was applied to the data are reported in Table 15. Of the 10 PCIs in the coding scheme, 6 were described by the participants. These were relative advantage, compatibility with current work practice, compatibility with preferred work style, ease of use, communicability, and trialability.

Table 15

Codes, Definitions, and Number of Applications for the Perceived Characteristics of Innovation Coding of Participants' Follow-up Interview Data

Code	Definition[a]	Number of applications
Relative advantage	The degree to which the innovation is perceived as being better than the other options – the comparison may be explicit (A is better than B) or implicit (A is better)	29
Compatibility with current work practices	The degree to which the innovation is perceived as being consistent with the way the potential adopter works now	18
Compatibility with preferred work style	The degree to which the innovation is perceived as being consistent with the way the potential adopter would like to work, even if that is not the way they work now	14
Ease of use	The degree to which an innovation is perceived as being easy to use	10
Trialability	The degree to which the innovation may be experimented with before adoption	2
Communicability	The degree to which the results of using the innovation can be easily communicated to others	1
Compatibility with prior experience	The degree to which the innovation is perceived as being consistent with the prior experience of potential adopters	0
Compatibility with values	The degree to which the innovation is perceived as being consistent with the existing values of potential adopters	0
Image	The degree to which using the innovation is perceived to enhance one's image or status in the organization	0
Measurability	The degree to which the impact of the innovation can be measured	0

[a]From Compeau and Meister (2003)

Three of these characteristics—relative advantage, compatibility with current work practice, and compatibility with preferred work style—were manifested in the data

in two ways: Participants either identified multiple manifestations of a perceived characteristic (i.e., stating more than one way RepliGo™ had a relative advantage over paper) or identified the same manifestation more than once. For example, Betty (pseudonym) identified two manifestations of relative advantage (conserving paper and correcting highlighting errors) when she says, "And rather than run off a forest of paper… they can do this kind of work on the laptop" and "because if they do make mistakes, they can go back and fix it." Both of these are unique relative advantages. Sometimes a participant mentioned the same relative advantage more than once. For example, Beth twice mentioned how using digital annotation in an assessment would be an improvement over multiple choice tests, saying "I can easily see how it would be to the students' advantages to have to think at a different level when they're answering digital material beyond a multiple choice question," and "[it is different than] from what I've previously done because most of what I've been able to deal with these kids has been multiple choice, which to me is a really weak way to pass a test." Thus Betty had two unique mentions of relative advantage while Beth had one.

A perceived characteristic was sometimes manifested in positive and negative ways, and sometimes by the same participant. Mary spoke positively about the compatibility of RepliGo™ with her current work practice when she said "…[generally] there's kind of a shift going from the physical papers to the online books. So [RepliGo™'s a way] they could use the online text more effectively in the classroom and outside the class, too." She spoke about the same perceived characteristic negatively when she said, "I'm just hoping they can work the kinks out of the system [RepliGo™] so that I can actually use it with the [online] texts that I have."

To accommodate for the ways perceived characteristics were manifested, two frequencies were generated from the data, and the direction of the perception (i.e., positive or negative) was noted. The overall frequency is the number of times a particular characteristic was present in the data and includes repeated mentions of the same characteristic. The unique frequency is the number of times a characteristic was manifested in the data in different ways. It does not include intra-participant repetitions (i.e, Beth's two mentions of RepliGo™ having relative advantage over multiple choice items count as one). However, inter-participant repetitions (i.e., two participants identifying the same relative advantage) are included. The observed and unique frequencies and direction of perceptions made by participants during their follow-up interview, voicemail, or email are displayed in Table 16.

Table 16

Frequencies and Perception of Statements from Follow-up Interviews, Voicemails, and Emails Across Participants (N=20)

Perceived characteristic[a]	Frequency		Perception	
	Overall	Unique	Positive	Negative
Relative advantage	29	25	24	1
Compatibility with current work practice	18	15	11	4
Compatibility with preferred work style	14	12	12	–
Ease of use	10	10	6	4
Trialability	2	2	1	1
Communicability	1	1	1	–
Total	74	65	55	10

[a]Based on Compeau & Meister (2003)

The total number of statements coded as a manifestation of a perceived characteristic of RepliGo™ totaled 72, with 65 (89%) of these unique. Statements were overwhelmingly positive. Participants made unique, positive statements about their perceptions of RepliGo™ 55 times (84%) as compared to 10 times (15%) with negative perceptions. This disparity could be due to (a) the use of convenience sample as 13 (65%) of the 20 participants in the sample indicated they would be participating in the field trial of RepliGo™ and (b) the fact that 9 (14%) of the unique responses, all positive,

originated in Betty's interview, a participant who chose to participate in the field trial and gave an interview eight times longer than the shortest interview.

Once the positive and negative direction of participants' perceptions of the perceived characteristics of RepliGo™ was determined, an examination of the interview and survey data was undertaken to determine the degree of triangulation between the two sources. The frequency of uniquely positive and negative statements made by a participant was compared with his or her PCIS (D. R. Compeau & Meister, 2003) subscale mean for the same characteristic. Data on four perceived characteristics were used in the triangulation. These were relative advantage, compatibility with current work practice, compatibility with preferred work style, and ease of use. Insufficient interview data prevented the triangulation of the communicability and trialability characteristics. This was due to the small number of times communicability and trialability appeared in the interview data. Table 17 displays the data used in the triangulation.

Table 17 presents the disaggregated data by field trial participation response. When examined this way, a pattern in the data emerges: Positive statements about a perceived characteristic are associated with the choice to participate in the field trial, especially for the perceived characteristic, relative advantage. Participants who chose to participate in the field trial also made more comments overall (51), with the majority (48 or 94%) of those being positive while participants who declined to participate in the field trial made fewer comments overall (9) with the majority of those being negative (6). These results are consistent with the PCIS (D. R. Compeau & Meister, 2003) means, which tend to be higher for field trail participants and lower for field trial non-participants.

Table 17

Participant Interview Duration, Field Trial Response, and Unique Statements about the Perceived Characteristics of RepliGo™

Participant	Interview duration (mins:secs)	Field trial participation response	Perceived characteristics of the innovation RepliGo™[a]												
			Relative advantage			Compatibility with current work practice			Compatibility with preferred work style			Ease of use			
			PCIS mean*	Unique statement frequency		PCIS mean**	Unique statement frequency		PCIS mean	Unique statement frequency		PCIS mean	Unique statement frequency		
				Positive	Negative		Positive	Negative		Positive	Negative		Positive	Negative	
1	01:58	Yes	7.00			4.00	1		7.00			6.80	1		
2	07:20	Yes	7.00	1		7.00	1		7.00	1		7.00			
3	03:14	Yes	6.71	3		6.50			7.00	2		6.20		1	
4	05:28	Yes	6.43	1		6.50	1		6.00			6.60			
5	02:42	Yes	6.43	4		6.00			6.00			6.00	1		
6	00:46	Yes	6.00	1		5.00			7.00			6.40			
7	02:12	Yes	6.00	1		6.00			6.00	1		6.00			
8	01:46	Yes	6.00			5.50	1		5.00	1		5.40	1		
9	16:45	Yes	5.86	9		6.00	3		5.00	4		5.20	1		
10	02:42	Yes	5.71	1		6.50			6.00	1		5.40			
11	01:51	Yes	5.43	1		7.00			7.00	1		6.00	1		
12	02:51	Yes	5.29	1		5.50	2	1	5.00			4.40		1	
13	02:27	Yes	5.00	1		4.50			6.00			5.20			
14[b]	03:22	No	6.14			6.50		1	6.00			6.20			
15	10:14[c]	No	5.29			3.50		1	4.00			4.60			
16	03:25	No	4.71			3.00			6.00			6.60			
17	00:38	No	4.00			2.00			3.00			4.80		1	
18	02:58	No	3.71			3.00		1	4.00	2		5.20			
19	–[d]	No	3.14			2.50			3.00			3.40		1	
20	02:40	No	3.00		1	4.00	1		4.00			3.00			

[a]Based on Compeau & Meister (2003)
[b]Outlier in logistic regression analysis
[c]Approximately two minutes of this interview was on-topic
[d]Email message
*Significant in the logistic regression analysis, $p < .05$
**Significant in the logistic regression analysis, $p < .01$

As the survey data indicated that some of the means on the PCIS showed moderate correlations between factors, the coding of the interview/voicemail/email data was examined to determine if any statements were coded with more than one perceived characteristic. Six intersection matrix searches were performed in NVivo™, one for each of the PCIs of RepliGo™ present in the interview data. Statements coded with more than one perceived characteristic were examined to determine if any single participant was the source of the double-coding. The unique coding intersections and the identification numbers of the participants are displayed in Table 18. No statements were coded with more than two PCIs. Four statements coded for relative advantage were also coded for compatibility with preferred work style, and one statement coded for relative advantage was also coded for ease of use. One statement was coded for both compatibility with current work practice and ease of use. The sources of the double-coded statements were five participants with one being the source of two of the statements.

Table 18

Frequency of Coding Intersections for the Perceived Characteristics of the Innovation of RepliGo™ and ID numbers of Participants with Double-coded Data

	Relative advantage		Compatibility with current work practice	
	Frequency	Participant ID	Frequency	Participant ID
Compatibility with preferred work style	4	2, 3, 6[a]		
Ease of use	1	9	1	10

[a]Participant 6 had two statements coded for relative advantage and compatibility with preferred work style.

Comparing the frequency of double-coded statements displayed in Table 16 with the unique frequencies reported in Table 14, the 6 double-coded statements represent 9% of the 64 unique statements from the 20 participants. Four of the six double-coded statements overlap between relative advantage and compatibility with preferred work style, and the overlap is similar to the correlation between relative advantage and compatibility characteristics noted in the logistic regression analysis. This is also similar to the PCIS results noted by Moore and Benbasat (1991).

Summary of the analysis of the interview data. From the analysis of the interview data, it is found that interview participants gave their reasons for their participation choice in ways that the PCIs were clearly evident. Participants spoke most about relative advantage and compatibility with current work practice, the two factors with the greatest

significance in the final logistic regression analysis. These two PCIs accounted for 40 of the 65 (62%) unique statements made by the 20 interview participants. While other PCIs were mentioned, this analysis supports the triangulation of the survey data. Thus the findings from the analysis of the follow-up interviews are (a) participants who were interviewed corroborated their field trial invitation response, and (b) the PCI constructs they mentioned triangulated the quantitative data they provided in the PCIS.

Response to research question 1. The research question guiding this portion of the study was, "To what extent does diffusion of innovations theory, as embodied in the Innovation Adoption Profile (IAP), indicate the micro-adoption decisions of secondary school teachers considering participating in a four-week trial of RepliGo™ digital annotation software?" In response, it is acknowledged that this initial examination of the IAP was constrained by a small sample, and thereby an evaluation of the 15-factor IAP model is not possible from this study. However, from the analysis of the data collected, portions of the IAP model are found to indicate participants' decisions to participate in the field trial of RepliGo™. Two factors in the IAP are indicated by the logistic regression analysis and triangulated by the analysis of participant interviews. Both are constructs from Compeau and Meister's (2003) iteration of Rogers' (2003) perceived characteristics of the innovation: compatibility with current work practice and relative advantage. In addition, three factors in the IAP model, the demographic proxies for innovativeness (i.e., age, educational attainment, career moves), are found not to be indicators of participants' decision to participate in the field trial of RepliGo™. These three proxies for innovativeness were dropped from the IAP model.

Question 2 - What are the deep-usage post-adoption outcomes of using RepliGo™ digital annotation software among secondary school teachers?

To answer this research question, two case studies of teachers' uses of RepliGo™ were developed. The data used to develop the case studies were provided by two teachers, Richard and Julia (pseudonyms). Both teachers participated in Phase 1 workshops in the spring of 2005 and in the Phase 2 field trial in their classrooms for four weeks in the fall of 2005. Both teachers taught in laptop high schools where teachers and students used laptop computers at home and school throughout the school year. This section briefly reintroduces Hughes (2000) RAT taxonomy, then presents a description of each teachers' use of RepliGo™ along with the application of the RAT taxonomy. The section concludes with a summary of the RAT analysis and a response to the research question.

As described in the Methods section, Hughes' (2000) Replacement-Amplification-Transformation technology use taxonomy (RAT) was used as an a priori coding scheme to analyze the data from Richard and Julia's interviews. RAT allows teachers' technology use to be classified into broad themes of use (i.e., instructional methods, student learning, curriculum goals) and categorizes the impact of using technology on each theme into one of three levels (i.e., replacement, amplification, transformation). The unit of analysis in RAT is what Hughes calls an *instance of use*. An instance of use occurs when technology is used before, during, or after a lesson. Identical lessons delivered to different students (i.e., when a teacher repeats a lesson several times in a day with different sections) are considered a single instance, but identical uses incorporated into different lessons are considered separate instances of use (i.e., when a

teacher asks students in a different section to complete a technology-supported formative assessment). In RAT, the themes of use represent *what* the technology changed and the levels indicate *how much* change occurred. The RAT taxonomy (Hughes, 2000) defines replacement as a teacher using technology that "...in no way, change[d] established instructional practices, student learning processes, or content goals" (p. 21). When a teacher uses technology as amplification "the focus is [on] effectiveness or streamlining rather than change" (p. 23). Transformation has occurred when one or more of the themes "was fundamentally different, thus, transformed, and the technology played a central role in developing such a transformation" (pp. 28-29).

Richard's instances of use. Richard taught Spanish to both native and non-native Spanish speakers in primarily grades nine and ten at Adams High School (pseudonym). He reported 11 instances of using RepliGo™ during the four week trial. Nine instances occurred when his students used RepliGo™ to complete formative assessments of their vocabulary skills. While these instances were of the same use, they are considered distinct because Richard's lesson plan and materials varied each time. One instance occurred when he projected text for an in-class discussion, and the last instance occurred across several uses as he used RepliGo™ to prepare the formative assessment materials for his students.

Richard's use of RepliGo™ for formative assessments of his students' vocabulary skills was something he suggested as a possible use during his workshop the previous spring. He thought they could use the software to highlight words they did not know in passages from his existing curriculum materials. Richard had his students use RepliGo™ to complete formative assessments in nine unique instances (i.e., Richard used a different

lesson plan), and each instance was repeated two or three times (i.e., Richard taught the same lesson two or three times in a school day). During these instances Richard became aware of changes in his students' behavior and his interactions with them.

Richard mentioned numerous times that more of his students' participated in the formative assessment activity using RepliGo™ than they did when using other methods, and he was able to check their understanding more rapidly. He says:

> Before I use[d] to project the [Spanish] story… I'd say "OK, we're going to read and translate, we're not going to read it out loud in Spanish." But maybe five or six kids in the whole class out of twenty-five would be actively participating in reading and/or translating… and the others might… [be] watching, but…there's no way to know for sure if they're daydreaming… or what. But when you use it [RepliGo™] and you project it and you say, "OK now it's on your computer, please open [it] up… and scan through it and [highlight] what you don't know"…Then you know everybody is getting involved and you can check on that right away (Richard:1,6)[5].

Richard attributed students' increased participation to RepliGo™ being a technological tool, one that students felt comfortable with and enjoyed using, saying:

> They enjoy it, they enjoy the technology and they enjoy learning it and they're naturals at it so when I give them an assignment… I get pretty much 97-98% of the students [to] just eagerly and gladly and willingly do the assignment. I mean they just jump right into it. They appreciate doing it very much. And a lot of it is related to just the fact that it is a computer and it's colorful. (Richard:1,1-2)

[5] Notations such as (Richard:1,6) refer to Participant:Interview 1, Transcript page number 6.

These two comments, taken together, are an example of technology as amplification in that the use of RepliGo™ by the students in Richard's class increased their motivation and their participation in the assessment activity. This use falls within the theme of student learning.

Richard valued the way RepliGo™ enabled his students to complete formative assessments, saying "…that [using RepliGo™] was a new approach and again a very rapid, visual bit of feedback for the teacher about what the kids say they don't know. I mean how often do kids voluntarily say 'I don't know something'?" (Richard:1,5). While Richard includes language referring to an increase in the speed of the assessment, which would make this instance of use as an amplification, this quotation is an example of a transformation, this time in the usage theme of instructional methods. RepliGo™, in Richard's mind, has produced a fundamental change in the willingness of his students to share with him what they need help with. Additionally, Richard now has access to such information that, heretofore, had been in the students' minds only.

Richard also credited RepliGo™ with changing his interaction with his students during the vocabulary assessments. He explained:

> It [RepliGo™] changes it in that… I am interacting with them, whereas when they're taking the quiz in Blackboard™ [the district's electronic course management software], I'm just walking around the room just to make sure they're not cheating…But with this… I want them to tell me what they don't know… so I'm walking around looking at… a lot of different screens seeing what's being highlighted… I mean that kind of assessment produces a lot more teaching… I'm saying you know, *buscar* means "look for," or I might gesture to

them or something or other as a reminder…That wouldn't be happening with just a quiz. (Richard:1,6)

Near the end of the field trial Richard brought up this same theme of interaction with students again, saying:

> So I think it's sort of put me moving around the room a little bit more, checking more directly on [students'] work, and... I think it's created that link and strengthened that particular activity because most of what I do is during class time, not afterwards, and I don't write lots of notes on papers… It's got to be during the class period that that's taking place. (Richard:3,7)

Richard used RepliGo™ to fundamentally alter his interactions with his students during formative assessments. Instead of moving about the room to prevent cheating, he gathered information from his students. Instead of issuing a quiz grade, he learned what his students did not know so quickly that he could assist them immediately. His interest in helping his students learn became more visible with this type of assessment made possible by RepliGo™. This transformation occurred early on and remained in place for the duration of the field trial.

Richard's second instance of use was to project a paragraph from a RepliGo™ file on his computer onto the projection screen at the front of his classroom. He then used RepliGo™'s highlighting tools to highlight parts of a paragraph in various colors as he was leading a whole class discussion on the meaning of the passage. He uses the term "overhead" to describe the hardware/software combination of computer, video projector, and RepliGo™, saying "... I posted it [the paragraph] up on the overhead [and] highlighted with different colors key sections…" (Richard:4,1). This use of RepliGo™

was using technology as replacement. The usage theme applied to this instance was instructional methods.

Richard used RepliGo™ several times to prepare passages for his students' formative assessments. Mostly brief stories, usually one page long, these passages were from his existing paper curriculum materials. He scanned these and used optical character recognition software to import them into a word processor. Once he corrected any errors, he converted them into RepliGo™ documents and distributed them to students using Blackboard™. Sometimes Richard converted materials that were already in electronic format (i.e., word processor files, web pages). Applying the RAT taxonomy (Hughes, 2000) to this instance was not possible because during his interviews, Richard did not compare materials preparation using RepliGo™ with how he prepared his prior formative assessment materials, namely quizzes.

Julia's instances of use. Julia taught Reading at Madison High School to students who had not yet passed the statewide reading assessment, and she had approximately 140 students each day across six sections. Julia had three instances of using RepliGo™, all related to a single lesson she repeated with each section throughout the same day. She used RepliGo™ to prepare an assignment for the lesson, her students used it to complete the assignment, and Julia used RepliGo™ again to view her students' work while scoring it.

The goals of Julia's lesson were to demonstrate the value of having a purpose while reading and to familiarize her students with using RepliGo™. The lesson consisted of an assignment to read and highlight a single page of text using RepliGo™. The text described a house and its contents and included directions to highlight the text according

to three purposes: what students found important, what a thief would find important, and what a potential home buyer would find important. Students were asked to highlight the text using a different color to identify each purpose. Julia did not create this assignment herself; she had previously obtained a paper version of it from a colleague. She had not used the assignment on paper before because she was not able to provide her students with the highlighter pens needed and thought that substituting other marks (i.e., underlining, circling) would be unsatisfactory.

Julia prepared the assignment by using RepliGo™'s file conversion software to convert a word processor file into RepliGo™ format, added the directions, and distributed the file to her students using Blackboard™. Students accessed the RepliGo™ file by logging into the class Blackboard™ site, where they worked with the file using RepliGo™'s browser plug-in software within their web browser. When they were finished, students used Blackboard™ to grant Julia access to their work. Julia then scored students' work by logging into Blackboard™ and viewing each student's RepliGo™ file inside a web-browser.

Out of the 140 students Julia taught that day, between 10 and 15 of them did not have their computers with them. Julia printed out the assignment and had these students complete it using a pen by underlining and circling the text. This unanticipated situation provided a natural point of comparison for Julia between paper and RepliGo™, especially when it came time for her to score the assignment.

Applying the RAT taxonomy to Julia's uses of RepliGo™, when Julia used RepliGo™ to prepare the assignment and distributed it to her students via the Blackboard™ course management system, she reported that the two software applications

streamlined the process "because I don't have to truck up to the copier and worry about whether or not [the copier is] actually working and that is a pretty big chunk of time…just to make copies" (Julia:1,7). RepliGo™ allowed her to make the worksheet electronic rather than paper, saving the time needed to travel to the photocopier and avoiding potential delays if the photocopier wasn't working. Blackboard™ let Julia distribute the RepliGo™ file quickly to all of her students, thereby avoiding having to pass out paper in class, which takes time. Because the result of using the technology was streamlining the preparation process, this instance of use was categorized as technology as amplification. Because it was Julia's preparation for teaching that was amplified, this instance of use falls under Hughes' (2000) theme of instructional methods.

Julia credited RepliGo™ with making it possible for her to consider using the assignment. Responding to a question on whether the availability of RepliGo™ affected her decision to use the assignment, Julia responded,

> Well, yes, because I don't have enough highlighters that are three different colors for the kids. So it's very difficult to do… we can't go through and do the three perspectives, and if they just try to do it with pen or pencil and underline versus circle, it just gets to be a mess and they can't really see the difference as clearly (Julia:1,4).

While the assignment was technically possible to do using highlighters and paper, for Julia it was possible to use technology to highlight text but not highlighter pens; they were a scarcer resource than laptops. Julia had actually considered using the assignment but had not done so until RepliGo™ became available. At the surface, this use of RepliGo™ as an assessment of students' ability to perceive purposes while reading seems

to represent a change in Julia's instructional methods. However, upon closer examination, it is difficult to say what changed because we do not know how Julia taught this concept *before* RepliGo™ was available. If she had never taught this concept before and RepliGo™ played a central role in making it possible, then this instance would have been categorized as transformation. If she had taught the concept before and used a different assignment to assess it, then this use of RepliGo™ would have been categorized as a replacement or amplification. In reality we do not know the categorization of this instance simply because we do not know if, or how, Julia taught the concept in the past.

Julia's third instance of using RepliGo™ was to view her students' work after they had completed the assignment. She noticed that more students turned in the assignment, reporting that "I'm looking at about 90% actually turned it in versus on any... typical assignment maybe 75% will turn it in" (Julia:1,5). It was also while viewing the work that Julia noticed the differences in the work done by students using RepliGo™ and the 10-to-15 students who did not have their laptops with them that day. Those students did the assignment on paper using a pen, and Julia reported "…when I look at their papers compared to the ones with [students' who used] RepliGo™, I'm just not so sure they [the paper-using students] got it as well" (Julia:1,5). So Julia noticed more students turned in this assignment and more students appeared to understand her goal of having a purpose while reading when they used RepliGo™. Because Julia reported an increase on her measures of student performance, but not a fundamental change, this instance of use of RepliGo™ is categorized as using technology as amplification, and because Julia perceived this instance when looking at student work, it is classified under the theme of student learning.

Summary of the RAT analysis of the cases. Richard's use of RepliGo™ to conduct formative assessments of his students' vocabulary skills transformed his instructional methods and amplified his students' learning. Apart from his use of RepliGo™ to prepare the assessments, this was his first use, one he mentioned during his first exposure to the software. Using RepliGo™ to project a passage for whole class discussion came later, near the end of the field trial. This use was a replacement of a set of older technologies (i.e., overhead projector, transparencies, markers) with a set of computer-based technologies (i.e., computer, video projector, RepliGo™) with no change in Richard's instructional methods, his students' learning, or the curriculum. Julia's uses of RepliGo™ amplified her instructional method by making her preparation of learning materials more efficient, and amplified her students' learning because more of them completed an assignment when they used RepliGo™. Both of these instances occurred within her first and only week of using RepliGo™, and she did not report a use that could be categorized as a replacement. This sequence supports the finding in Hughes' (2000) study of technology use among English teachers: Teachers' level of technology use does not follow a sequential order and is not based on experience with the technology. Neither Richard nor Julia began by using RepliGo™ as a replacement for existing tools and then later used it to amplify and finally transform their practice. Instead, they used RepliGo™ in pursuit of goals that mattered to them.

Response to research question 2. The research question guiding this portion of the study was "What are the deep-usage post-adoption outcomes of using RepliGo™ digital annotation software among secondary school teachers?" In response, the RAT analysis of the data from Julia and Richard during their four-week trial of RepliGo™

represents deep-usage information. This analysis reflects authentic post-adoption outcomes in line with Rogers' (2003) definition of adoption as "a decision to make full use" (p. 21) of an innovation and is a significantly better descriptor than duration, a common measure in diffusion of innovation (DOI) research. A duration measure would not have captured how Richard and Julia amplified and transformed their practice within the first hours and days of use. Conversely, merely reporting duration would also have resulted in an overstatement of both Richard and Julia's usage because they individually used RepliGo™ the same way multiple times during the field trial. For example, the students in each of Julia's six Reading sections only used RepliGo™ once for less than 50 minutes, but a duration measure of *her* use would have reported a number 6 times greater. Thus Hughes' (2000) instance construct is more illustrative of how teachers actually use technology in their practice, and analyzing those instances with the RAT taxonomy allows decision-makers to see the *impact* of the technology in the classroom. Shallow-usage measures tell us *how much* an innovation is used. Deep-usage measures such as the RAT taxonomy tell us *the difference made* by that usage. Thereby one of the findings of this study is that a deep-usage measure such as the RAT taxonomy provides valuable information on the post-adoption outcomes of teachers' uses of a technological innovation.

Question 3 - What is the relationship between teachers' IAP results and their deep-usage post-adoption outcomes from the four-week trial of RepliGo™ digital annotation software?

The third research question that guided this study was "What is the relationship between teachers' initial perceptions of RepliGo™ and their perceptions that emerge

from their deep-usage post-adoption outcomes data?" The question was answered through an analysis of the data from Richard and Julia that were collected during Phase 1 and Phase 2 of the study. Data from Phase 1 included the results of the PCIS (D. R. Compeau & Meister, 2003) and the brief follow-up interview that was conducted shortly after their workshop on RepliGo™. Data collected during Phase 2 consisted of the transcripts of Richard and Julia's telephone interviews that occurred over the four weeks they were using RepliGo™ in their classrooms. As the data analysis undertaken to answer this question pertains to what Richard and Julia said about their perceptions of RepliGo™, the perceived characteristics of the innovation constructs (PCIs) are the organizing framework for the analysis. The PCIs were used to analyze the data collected to answer this question, and the results are presented using the PCIs as a framework. This section briefly reintroduces the PCI constructs, presents the PCIs that emerged from Richard and Julia's Phase 1 and Phase 2 data, and concludes with the response to the question.

The Perceived Characteristics of the Innovation (PCIs). In DOI theory as explained in Rogers (2003), the Perceived Characteristics of the Innovation (PCIs) are a set of theoretical constructs that help explain why some innovations are adopted by individuals more readily than others. They form the key input into what Rogers calls the Persuasion Stage in his model of the innovation-decision process (displayed in Figure 1) and are qualities of the innovation, not the individual. One of the underlying assumptions of DOI theory is that when individuals consider whether or not to adopt an innovation, they consciously and/or subconsciously consider one or more of the PCIs when making their choice. The PCIs have undergone refinement since first being articulated in the

1940's, and, while the PCI relative advantage is considered canonical, others (i.e., compatibility, complexity, observability) have, over time, been modified and expanded upon. Appendix I presents the list of 10 PCIs used in this study and their definitions.

Perceived Characteristics of the Innovation in the data. Richard and Julia fully participated in the Phase 1 data collection that occurred during April and May of 2005. They each attended an introductory workshop, completed the four IAP surveys, and participated in a follow-up interview where they explained their reasons for choosing to participate in the field trial of RepliGo™. One of the surveys, the PCIS (D. R. Compeau & Meister, 2003), quantitatively measured Richard and Julia's perceptions of RepliGo™ using Compeau and Meister's 10 PCI constructs as subscales. Each subscale produced a mean derived from responses to Likert-scale items. The range of possible responses was from one (strongly disagree) to seven (strongly agree) with four (neutral) being the mid-point. Higher numbers indicate more positive perceptions of RepliGo™. Table 19 presents Richard's perceptions of RepliGo™ on (a) the 10 PCIs as represented by his PCIS subscale means, (b) the PCIs that emerged from the analysis of his follow-up interview, and (c) the direction of his perceptions (i.e., positive or negative). Table 20 presents the same information for Julia.

Table 19

Richard's Initial Perceptions of RepliGo™'s Characteristics as Reflected in His PCIS Subscale Means and Follow-up Interview

Characteristic	Initial perceptions of RepliGo™		
	PCIS[a] subscale mean	Expressed in follow-up interview	
		Positive	Negative
Relative advantage*	5.0000	2[a]	
Compatibility with current work practice**	4.5000		
Compatibility with preferred work style	6.0000		
Compatibility with prior experience	5.5000		
Compatibility values	7.0000		
Ease of use	5.2000		
Image	5.4000		
Communicability	5.5000		
Measurability	4.6670		
Trialability	6.7500		

[a]Compeau & Meister, 2003.
Each value is a subscale mean between 1.0000 and 7.0000
[b]Includes duplicate
*Significant in the full population logistic regression analysis (p=.025).
**Significant in the full population logistic regression analysis (p=.004).

Table 20

Julia's Initial Perceptions of RepliGo™'s Characteristics as Reflected in Her PCIS Subscale Means and Follow-up Interview

Characteristic	Initial perceptions of RepliGo™		
	PCIS[a] subscale mean	Expressed in follow-up interview	
		Positive	Negative
Relative advantage*	5.4286	1	
Compatibility with current work practice**	7.0000		
Compatibility with preferred work style	7.0000	1	
Compatibility with prior experience	6.5000		
Compatibility values	7.0000		
Ease of use	6.0000	1	
Image	3.0000		
Communicability	7.0000		
Measurability	5.0000		
Trialability	3.0000		

[a]Compeau & Meister, 2003.
Each value is a subscale mean between 1.0000 and 7.0000
*Significant in the full population logistic regression analysis (p=.025).
**Significant in the full population logistic regression analysis (p=.004).

Phase 2 of this study occurred during the four-week field trial of RepliGo™ in Richard and Julia's classrooms. During this time they participated in weekly telephone interviews. Data from these interviews were first analyzed using Hughes' (2000) RAT taxonomy in order to answer research question two pertaining to teachers' deep-usage of RepliGo™. To answer this third research question, the data were re-coded using Compeau and Meister's (2003) PCIs as an a priori coding scheme, but with one change: the substitution of Rogers' (2003) overall compatibility construct for Compeau and Meister's four compatibility sub-constructs (i.e., compatibility with current work practice, compatibility with preferred work style, compatibility with values, compatibility with prior experience). This substitution was based on the determination that the data from the Phase 2 interviews were not sufficiently detailed to support Compeau and Meister's finer-grained compatibility constructs. Table 21 displays the results of the PCI coding of the Phase 2 data collected from both Richard and Julia.

Table 21

Richard and Julia's Perceptions of RepliGo™'s Characteristics as Reflected in Their Field Trial Interviews

Characteristic[a]	Perceptions of RepliGo™ expressed in field trial interviews			
	Richard		Julia	
	Positive	Negative	Positive	Negative
Relative advantage	13		9	2
Compatibility[b]	6			3
Ease of use	8		4	3
Image				
Communicability				
Measurability				
Trialability				

[a]Compeau & Meister, 2003

[b]Rogers' (2003) overall compatibility construct was substituted for Compeau & Meister's (2003) four compatibilibilty constructs.

While the PCIS measured Richard and Julia's perceptions of RepliGo™ across 10 PCIs, a much smaller number of PCIs emerged from their interviews. Julia only mentioned three PCIs (relative advantage, compatibility, and ease of use) during her Phase 1 follow-up interview, and Richard only mentioned one (relative advantage). Both teachers mentioned only these same three PCIs during their Phase 2 field trial interviews. The emergence of these three PCIs in both phases is not surprising given that Tornatzky and Klein (1982) found in their meta-analysis of 75 DOI studies that the same three PCIs "had the most consistent significant relationships to innovation adoption" (p. 28). Richard and Julia's mention of relative advantages of RepliGo™ during both the pre-adoption

Phase 1 and the post-adoption Phase 2 interviews also provides qualitative evidence of the stability of this PCI across time. This means that, for these two teachers, relative advantage is an indicator of two distinct stages in Rogers' (2003) innovation-decision model: the decision stage and the implementation stage.

Merely noting Richard and Julia's mention of these three PCIs (relative advantage, compatibility, and ease of use) from pre- through post-adoption would be insufficient. The direction of their perception (i.e., positive, negative) is equally important in explaining their use of RepliGo™ during the field trial.

While Richard's Phase 1 data were always positive, they were not a particularly good predictor of the strength of his perceptions during Phase 2. His PCIS means showed mostly moderate levels of agreement with the survey items, and while he did articulate a relative advantage during his Phase 1 interview, it was not well-formed: "…it [RepliGo™] gives you some additional tools to help the students focus on that particular passage" (Richard, 1:1). This stands in contrast to what he said during his first Phase 2 interview:

> …it [RepliGo™] is strengthening any kid who participates in it. It's going to strengthen those neural connections because they're not just looking at it on the piece of paper, they're having to highlight that word, then they see the word over on the left-hand side where [the] comments [are]… and then they have to go over there and edit that word and type in what it means next to it or change the color, and I do have them do different colors… I think I can see that it gives us the ability to reach those kids with that vocabulary whereas if you just projected it on

> the board or gave them a sheet of paper they might or might not look at it (Richard, 2:4)

Richard's experience with RepliGo™ in his classroom quickly confirmed and strengthened his initial perceptions. This first interview occurred just one week into the field trial, and already Richard's perceptions were well-defined. These pre-adoption perceptions went from moderate and unclear to strong statements across all three post-adoption PCIs about how RepliGo™ was positively impacting his teaching practice. This means that Richard was thinking about the impact of RepliGo™ on his teaching practice, and when his thinking was analyzed using the PCI framework, the PCI analysis detected the perceptual shift that occurred between his follow-up interview and his first field trial interview.

For Julia, the pre- and post-adoption data indicated a reversal of her perceptions, and these clearly explained her discontinuance after only three instances of using RepliGo™ in the context of a single lesson. Her PCIS data showed moderate agreement on relative advantage, but her compatibility mean indicated the maximum level of agreement. This was supported by what she said during her Phase 1 interview, where she was clear about the compatibility of RepliGo™ with her goals, saying:

> …we've [Reading and ESL teachers] been talking all year about how to improve our reading comprehension scores because we've got kids that are… pretty low. We're concerned about them on the [state-mandated reading assessment[6]]. And most of the research says that we need to get them interacting with the text, and

[6] Julia frequently mentions this assessment by name and including it would identify her state. "State-mandated reading assessment" will appear each time to avoid disclosing this, including in her quoted material.

marking the text and digital annotation fits really well into that. It's a tool we can use to help them with marking the text and interacting with the text. (Julia:1,1)

During her Phase 2 interviews Julia pointed out RepliGo™'s relative advantages over using paper for the same type of assessment and noted its ease of use when she described how little difficulty her students had in learning to use it: "…they actually figured it out really quickly… [there] were very few kids that had a hard time using it, which kind of surprised me" (Julia, 2:1). But it was the reversal in her perceptions of RepliGo™'s compatibility with the goals of her class that signaled her discontinuance.

As mentioned above, during the spring of 2005 Julia was clear RepliGo™ would help when preparing students for the state-mandated reading assessment. This was important to her. After all, each of her approximately 140 students was in her class because he or she had failed to pass the assessment at least once in the past. This was a high-stakes test; students' graduation from high school and the school's reputation in the community hinged on how well they did on this assessment. This was not something Richard had to be concerned with as his subject, Spanish, had no mandated statewide assessment.

During the Phase 2 field trial Julia was interviewed weekly. Her first interview was the source of favorable perceptions of RepliGo™. During her second interview she admitted that she had not had time to prepare and teach another lesson using the software, but stated a clear plan on what she wanted to do before the next interview: "…we're about to go into working on poetic elements. You know simile, metaphor, personification. So I was actually thinking about maybe putting some poems on there [RepliGo™] and having them identify the different elements" (Julia, 3:2). During this

interview she also commented on how easy it was to score student work from the first RepliGo™ assignment.

Julia's third and final interview revealed a core incompatibility between RepliGo™ and the purpose for her course. She began by stating she was "not able" to use the software, but was "hoping to be able to use it by the end of this week" (Julia, 3:1). Invited to share any of the barriers she had encountered, Julia stated the incompatibility by saying:

> The class that I teach in [is] a state-mandated reading assessment-like activity. Because that's our ultimate goal is that all the skills we're going over are state-mandated reading assessment skills, because they're [students] in my class [they] are deficient in some way in their knowledge of the state standards, and the ultimate goal is… that they… proficiently master the state-mandated reading assessment objectives and master them and practice them on their own… Honestly, a lot of it in order to model the state-wide reading assessment really had to be done in a multiple choice… format (Julia, 4:2).

So Julia's experience with RepliGo™ as an innovation started out with her strong perceptions of compatibility and ease of use along with clearly stated goals for using the software with her students. These perceptions were confirmed during her first use, but initial success with the innovation was not the determining factor for Julia to continue using RepliGo™. Her positive perceptions of the innovation broke down under the pressure to prepare her students to pass the state-mandated reading assessment. In the end she was unable to justify continuing to use an innovation she had come to perceive as

incompatible with the state-mandated assessment. Again, like the analysis of Richard's interviews, the PCI analysis was able to detect the shift in Julia's perceptions.

Response to research question 3. The research question guiding this portion of the study was "What is the relationship between teachers' IAP results and their deep-usage post-adoption outcomes from the four-week trial of RepliGo™ digital annotation software?" In response, in the case of these two teachers, the PCIs relative advantage, compatibility, and ease of use emerged from the deep-usage post-adoption data collected during the field trial of RepliGo™. The relationship between Richard and Julia's initial perceptions and those that emerged during the field trial is clear: Richard's initial perceptions were strengthened by his use while Julia's were overwhelmed by the weight of the state-mandated assessment. DOI theory was able to explain both outcomes, and Rogers (2003) statement that relative advantage and compatibility "are particularly important in explaining an innovation's rate of adoption" (p. 17) held true.