RELATIONSHIPS BETWEEN SELF-DIRECTION, EFFORT AND PERFORMANCE IN AN ONLINE INFORMATION TECHNOLOGY COURSE

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Overview

During fall, 2008, eighty-five students enrolled in an online junior-level information technology course – IT Concepts – at the University of South Florida Polytechnic. Students were administered a self-direction survey, both in the first two weeks of the course (pre-test) and in the last two weeks of the course (post-test), to determine the level of self-perceived, self-direction orientation, prior to and after the online learning experience. Along with this instrument, an additional survey assessing students' other learning habits was also administered. The results were combined with effort and performance metrics in the course, and statistical analysis performed to determine what, if any, relationships existed. Several such relationships emerged, and are discussed. The *absence* of other relationships is interesting in its own right; these anomalies are pointed out.

Purpose/Problem

The authors, in previous work, have made use of the PRO-SDLS instrument for measuring students' perception of their self direction (Gaspar, Langevin, Boyer, & Armitage, 2009b). This prior work was focused on the use of peer learning forums and the impact of this intervention on students' perceptions of their level of self-direction. In addition, analysis was performed to determine whether observed behaviors in these peer learning forums aligned with student response on the PRO-SDLS.

One factor limiting the applicability of the findings of this previous work was the comparatively low enrollment in those courses, and consequently a low N, which made achieving statistical significance difficult. We began utilizing the PRO-SDLS in other, higher-enrollment courses, with an eventual aim of extending previous findings into the realm of statistical significance. In some of the departmental IT courses, administration of this instrument, in conjunction with other surveys, is now routine.

We have hypothesized that the degree of self direction exhibited by a student should have a positive influence on the effort and performance shown by that student, especially in an online course, in which a larger amount of the responsibility for accomplishing work in a timely and

satisfactory manner is placed on the student. Although the PRO-SDLS, by its nature, can measure only the students *perceived* self-direction, we were hopeful that a high self-direction score would be predictive of greater effort and performance in an online course.

Our first research question for this study could therefore be stated: *1. Can the PRO-SDLS, or some item(s) thereof, be used in a predictive or prescriptive mode in regard to future course effort or performance?*

Our second research question related to a result found in previous work (Gaspar, Langevin, Boyer, & Armitage, 2009b) in which participation in that course apparently *decreased* students' perception of their self-direction. Thus both pre and post administrations of the PRO-SDLS were again used in this course, with the aim of measuring *changes* in perceived self-direction over the course duration, possibly related to course performance.

We state our second research question for this paper: *2. Are changes in perceived self-direction related to either performance or effort in a course?*

We recognized that other factors, in addition to a student's participation in this course, may have affected their perception of their self-direction over the same time period. However, as none of the information technology degree programs at USF Polytechnic can be classified as "cohort" curricula, and additionally due to the largely part-time nature of our student population, we consider it unlikely that there was another, concurrent experience that a significant portion of our sample was exposed to in common during this semester.

Sample/Population

The University of South Florida Polytechnic has been, for virtually all of its existence, a junior-senior-masters institution; only very recently did we receive authorization to begin enrolling freshmen and sophomores. Public community colleges in Florida have thus been our primary sources of students, many of whom work fulltime and are raising families. A recent survey of students taking IT Concepts found that 47.5% are employed full-time, while an additional 29.3% report part-time employment. Only 20.2% report that they are unemployed. Close to 90% of students who take this course report that they are planning to complete a degree program in information technology. Degree completion (junior and senior years) typically takes well over two years, consequent to part-time enrollment due to employment and family commitments.

The online nature of information technology courses at USF Polytechnic is apparently not a barrier for most students; at the start of the semester, over 60% report having taken a totally

asynchronous online course before, over 80% feel "reasonably confident in the use of technology for online courses," and over 85% report they are "reasonably confident" of their ability to stay on track and on schedule in the course.

Eighty-five students, comprised of a mix of traditional and non-traditional students, enrolled in the asynchronous online junior-level IT Concepts course at USF Polytechnic in fall, 2008. Eighty-two of these students submitted surveys at the start of the semester. Due to attrition, 72 students received grades at the end of the semester, of which 60 submitted end-of-semester surveys. Casewise deletion was used during preprocessing, providing a sample size of 60 for this study.

Methods

For the purposes of this study, the Personal Responsibility Orientation model (Brockett & Hiemstra, 1991) will be used as a foundation for investigating self-directed behaviors with the information technology discipline. Brockett & Hiemstra describe self-direction as a combination of process and personal elements that in which an individual "assumes primary responsibility for a learning experience" (pg. 24). Within their model, despite the emphasis placed on the internal characteristics of the individual, the social context also plays a critical role surrounding the learning experience. The concept of self-direction is not a new one (Merriam & Brockett, 1997) and many have attempted to find ways to incorporate strategies to encourage self-directed behaviors within certain learning environments and disciplines.

The concept of self-directed learning is aligned with any delivery, content area, and context of learning. In a nationwide study, 64% of businesses indicated that the applied skills of lifelong learning/self-direction were expected to have an increasing importance over the next five years (Conference Board, Corporate Voices for Working Families, Partnership for 21st Century Working Skills, & Society for Human Resource Management, 2006). While 78.3% of businesses felt that lifelong learning/self-direction were very important in the workforce, only 25.9% rated 4-year college graduates as excellent in this area. These concepts are important in all fields, but are particularly critical for information technology specialists, in particular computer programmers.

Instrumentation

We employed separate self-direction and learning habit assessments, as well as performance and effort metrics paired with those assessments:

- Self-direction assessment: PRO-SDLS "Learning Experience Scale" instrument (Stockdale & Brockett, 2006) was used to assess student self-direction. Reverse-polarity instrument

items were inverted prior to analysis. Previous studies have indicated that the PRO-SDLS total instrument (.89) and instrument factors are reliable: self-efficacy (.83), motivation (.83), control (.81) and initiative (.80) (Gaspar, Langevin, Boyer & Armitage, 2009b). Overall, these strong alpha values suggest confidence that the questions are adequately capturing the concepts that we hope to measure.

- Learning habit assessment: A learning habits survey described in previous research was used to determine aspects of our students' learning process such as time devoted to coursework, nature of the learning activities in which students are engaged, etc. (Gaspar, Langevin, Boyer, & Armitage, 2009a).
- Performance metric: The weighted course average served as the course performance metric. Weighting was performed in accordance with factors specified in the course syllabus, and did not include any extra credit work, including the "effort" items described below.
- Effort metric: Students were given the opportunity to earn "extra-credit points" throughout the semester. Of the 102 possible extra-credit points, 66 of these were based virtually entirely on effort. Examples were posting over and above the number of posts required for full credit on discussion topics, unlimited-time quizzes that involved reference to readily available web sources, and completion of surveys. We summed this subset of extra-credit points and defined it as an "effort" metric, vs. performance, as the contributing activities involved little but the expenditure of the student's time.

Findings

PRO-SDLS Data

As described above, raw data from both pre and post administrations of the PRO-SDLS instrument were processed so as to invert "negative" items, so the magnitude of each item response is positive in its contribution to the self-direction metric sum.

Table 1 shows descriptive statistics for the PRE and POST-course administrations of PRO-SDLS total scores (with negative items inverted as described above). Although there is a slight decrease in mean score from PRE to POST, the overall changes are not significant, at least at the summed score level.

Correlating the PRE and POST summations yielded a Pearson coefficient of .553 (sig=.000), showing fairly strong but not overwhelming consistency between the two administrations.

Table 1. Descriptive Statistics

	PRE-SUM	POST-SUM
Mean	95.13	93.13
Median	94.00	94.50
Std. Deviation	11.435	10.453
Range	52	54
Minimum	69	59
Maximum	121	113

To attempt to determine which contributing self-direction questions tended to be answered more consistently between the PRE and POST administrations, we ranked the items making up the PRO-SDLS on the basis of their PRE-POST correlations (Table 2.), including the mean PRE and POST scores for each item and the net POST – PRE change (Delta). Correlation coefficients significant at the .01 level or better were marked with two asterisks, while those significant at the .05 level were marked with one asterisk. Also, text for items whose responses were reversed (5=Strongly Disagree, 4=Disagree, . . . , 1=Strongly Agree) are marked with an ↔, and means and deltas are underlined.

A low rank number in Table 2 indicates that there was significant correspondence between how students answered the item before the course and how they answered it following the course experience. A high rank number indicates that there was statistically insignificant correspondence between how students answered the item before the course and how they answered it following the course experience.

The PRO-SDLS instrument groups items into four factors: Initiative, Control, Self-Efficacy and Motivation. Items in Table 2 have been annotated (in brackets) with a code (I, C, SE or M) to indicate the factor to which the item belongs. When we examine the rankings in light of these factors, we find that they separate out:

- Motivation factor (average rank of 9.1): Not as affected by the course experience.
- Control factor (average rank of 12.3) and Initiative factor (average rank of 13.5): Somewhat affected by the course experience.
- Self-Efficacy factor (average rank of 17.7): More affected by the course experience.

These rankings seem to support the ideas that (a) students' perception of their motivation does not change greatly over the semester, but that (b) students' perception of their self-efficacy exhibits a greater degree of change over the semester.

Table 2. PRO-SDLS Items, Ranked by PRE-POST Correlation Coefficient

Rank	ITEMS (Ranked by Pearson r)	Pearson r	PRE mean	POST mean	Delta
1	2. I frequently do extra work in a course just because I am interested. [I]	.674**	3.53	3.65	.12
2	16. The primary reason I complete course requirements is to obtain the grade that is expected of me. ↔[M]	.606**	2.55	2.28	-.27
3	11. For most of my classes, I really don't know why I complete the work I do. ↔ [M]	.588**	3.87	3.93	.07
4	23. I always effectively organize my time. [C]	.575**	3.58	3.63	.05
5	3. I don't see any connection between the work I do for my courses and my personal goals and interests. ↔ [M]	.522**	4.02	3.78	-.23
6	19. I am very successful at prioritizing my learning goals. [C]	.515**	3.88	3.87	-.02
7	20. Most of the activities I complete for my college classes are NOT really personally useful or interesting. ↔ [M]	.495**	3.65	3.60	-.05
8	8. I complete most of my college activities because I WANT to, not because I HAVE to. [M]	.434**	3.80	3.92	.12
9	7. I am very confident in my ability to independently prioritize my learning goals. [SE]	.413**	4.10	4.12	.02
10	25. I always rely on the instructor to tell me what I need to do in the course to succeed. ↔ [I]	.409**	3.43	3.30	-.13
11	10. I often use materials I've found on my own to help me in a course. [I]	.386**	3.85	3.80	-.05
12	1. I am confident in my ability to consistently motivate myself. [SE]	.335**	4.35	4.30	-.05
13	5. I always effectively take responsibility for my own learning. [C]	.331**	4.22	4.28	.07
14	9. I would rather take the initiative to learn new things in a course rather than wait for the instructor to foster new learning. [I]	.310*	3.55	3.50	-.05
15	12. I am very convinced I have the ability to take personal control of my learning. [SE]	.301*	4.23	4.20	-.03
16	6. I often have a problem motivating myself to learn. ↔[C]	.293*	3.98	3.73	-.20
17	13. I usually struggle in classes if the professor allows me to set my own timetable for work completion. ↔[C]	.288*	3.87	3.55	-.32
18	4. If I am not doing as well as I would like in a course, I always independently make the changes necessary for improvement. [C]	.276*	4.02	4.07	.05
19	18. The main reason I do the course activities is to avoid feeling guilty or getting a bad grade. ↔ [M]	.215	3.45	3.30	-.15
20	14. Most of the work I do in my courses is personally enjoyable or seems relevant to my reasons for attending college. [M]	.213	3.95	3.82	-.13

21	22. I am unsure about my ability to independently find needed outside materials for my courses. ↔[SE]	.207	3.97	4.02	.05
22	15. Even after a course is over, I continue to spend time learning about the topic. [I]	.200	3.50	3.27	-.23
23	17. I often collect additional information about interesting topics even after the course has ended. [I]	.160	3.50	3.22	-.28
24	21. I am really uncertain about my capacity to take primary responsibility for my learning. ↔[SE]	.111	4.17	3.90	-.27
25	24. I don't have much confidence in my ability to independently carry out my student plans. ↔[SE]	.075	4.17	4.10	-.07

Learning Habit Data

The fairly rudimentary learning habit data collected at the end of the semester, using a survey for which the student received 5 extra-credit points, was selected for use in this study. This data included a categorized estimate of hours spent per week by the student, as well as whether specific learning activities were engaged in when working on the course. Finally, a count of the *number* of those learning habits engaged in by the student was computed. The items and their mean responses are shown in Table 3.

Table 3. Learning Habit Data Means

Item	Mean of responses
How much time did you spend each week working on this course?	4.8 hours
Learning Activities:	
Reading the textbook (assigned chapters)	27%
Reading the textbook (unassigned or extra material)	10%
Doing assigned exercises (the graded ones)	90%
Doing assigned exercises (non-graded ones)	45%
Doing unassigned exercises (extra ones picked by yourself)	13%
Redoing exercises for which you already have the solution	47%
Reading the solutions to such exercises without redoing them	20%
Searching online for extra material (explanations)	72%
Searching online for extra material (exercises to do)	33%
Searching online for extra material (code samples)	23%

Count of Learning Activities checked	2.4 activities

The seeming anomaly in Table 3 – that far fewer students reportedly spent time reading assigned chapters in the textbook than in searching online for explanations – is a false one; in fact, there was no required textbook for this course, and one optional text used in the online discussion topics. The response level on this item should therefore be regarded as representing the proportion of students who read the optional text in conjunction with, or as preparation for the online discussions.

Performance Data

The Performance metric for this study, as mentioned above, consisted of the weighted course average earned by each student. This was computed strictly from assessments in the course, weighted by factors specified in the Syllabus: Exams: 45%, Assignments & Quizzes: 35% and Discussion Topics: 20%. No extra-credit points were included in this metric.

The mean for the Performance metric was 75.2%, with a standard deviation of 11.7%. The minimum was 35.9%, while the maximum was 91.4%.

Effort Data

Extra-credit points based on effort rather than expertise were collected into a metric to estimate the personal effort by the student over the course of the semester. The maximum number of points that could be earned by a student was 66. All students in the sample have at least 15 points, inasmuch as this was the number of extra-credit points that students received for completing the end-of-semester surveys. As described above under Sample/Population, 12 students (out of 72 receiving a final grade in the course) did *not* complete the end of semester surveys and were dropped (casewise deletion) from the sample. Sixty students did complete the survey, and are part of the study sample.

The mean for the Effort metric was 39.8 points, with a standard deviation of 14.0 points. The minimum Effort score was 16, while the maximum was 66.

Intercorrelations Between The Four Metrics

Correlations were run between the primary components of four metrics:

- PRO-SLDS: PRE-SUM and POST-SUM

- Learning Habits: Hours Spent per Week and Count of Learning Activities Engaged In
- Course Weighted Average (Performance Metric)
- Effort Metric (Non-expertise extra-credit points)

Correlation results are shown in Table 4 below. N for all correlations is 60.

Table 4. Correlations between Primary Metrics in this Study

	Weighted Average	Effort	PRO-SDLS PRE-SUM	PRO-SDLS POST-SUM	Hours Spent per Week	Learning Activity Count
Weighted Average	r = 1.00	r =.181 sig=.166	r =.074 sig=.576	r =.284* sig=.028	r =.159 sig=.224	r =.112 sig=.394
Effort	r =.181 sig =.166	r = 1.00	r =.178 sig =.174	r =.061 sig =.642	r =.296* sig =.022	r =.097 sig =.461
PRO-SDLS PRE-SUM	r =.074 sig=.576	r =.178 sig=.174	r = 1.00	r =.553** sig=.000	r =.324* sig=.012	r =.135 sig=.304
PRO-SDLS POST-SUM	r =.284* sig=.028	r =.061 sig=.642	r =.553** sig=.000	r = 1.00	r =.202 sig=.122	r =.255* sig=.049
Hours Spent per Week	r =.159 sig=.224	r =.296* sig=.022	r =.324* sig=.012	r =.202 sig=.122	r = 1.00	r =.068 sig=.607
Learning Activity Count	r =.112 sig=.394	r =.097 sig=.461	r =.135 sig=.304	r =.255* sig=.049	r =.068 sig=.607	r = 1.00

The only strongly significant relationship we see is that which was previously discovered: the coefficient of .553 between PRE and POST PRO-SDLS sums. There are, however, some less strong, yet statistically significant relationships that show themselves:

- While there is *no* significant relationship between the PRO-SDLS PRE score and our Performance metric (the course weighted average), there *is* a statistically significant positive correlation (r=.284, sig=.028) between the PRO-SDLS *POST* score and the Performance metric. Although this cannot be viewed as a strong correlation, it may suggest that the course experience itself affects students' perception of their self-direction, whether positively or negatively, and may tend to partially "ground" a student's perception about themselves in reality – at least the reality represented by this one course they have taken.

- The pre-test PRO-SDLS overall score *does* have a statistically significant relationship with one other metric. There is a coefficient of .324 (significant at the .012 level) with one of our Learning Habits components: *Hours Spent per Week*. When we delve more deeply into the source of this coefficient (by examining correlations of Hours Spent with individual pre-test PRO-SDLS items), we can pick up a common thread of *understanding why the student is doing the work* among three (8, 11 and 14) of the four items that show significant relationships with Hours Spent:
    - 1. I am confident in my ability to consistently motivate myself. (r=.265, sig=.041)
    - 8. I complete most of my college activities because I WANT to, not because I HAVE to. (r=.380, sig=.003)
    - 11. [inverted item] For most of my classes, I really don't know why I complete the work I do. (r=.319, sig=.013)
    - 14. Most of the work I do in my courses is personally enjoyable or seems relevant to my reasons for attending college. (r=.314, sig=.015)

  Interestingly, this correlation drops in value (to .202) and loses its statistical significance by the time the student takes the PRO-SDLS at the *end* of the course.
- The post-test PRO-SDLS displays a weak (r=.255) and barely significant (sig=.049) positive relationship with the number of learning activities engaged in by the student. There were no individual post-test PRO-SDLS items that correlated significantly with this metric. We suggest that no implication should be inferred by this statistical relationship.
- The Effort metric correlated significantly with only one other metric: Hours Spent per Week (r=.296, sig=.022). We suggest that these are related only because students who spend more time on extra-credit items would inevitably spend more time on the class.

What is "missing" in statistical significance may be as interesting as what is significant. As mentioned above, there is *no* significant relationship between the PRO-SDLS PRE score and our Performance metric (the course weighted average). In fact, the correlation coefficient (.074) suggests close to a random relationship between students' perception of their self-direction and their later success in this course. There are a number of ways in which this might be interpreted. For example, students' perception of their self-direction may be inaccurate or unrealistic at the start of the semester. Another interpretation would be simply that this course did not provide much opportunity for self-direction to show itself; this explanation, however, would not account for the relationship (not strong, but significant) between performance and perceived self-direction that develops by the *end* of the course.

It seems clear, however, that we can draw the conclusion that, for this sample in this course, the *pre-test* PRO-SDLS overall score cannot be used to predict success in the course, as defined by achieving a good weighed average.

But what about individual items on the pre-test PRO-SDLS? Examination of correlations between our Performance measure and individual PRO-SDLS items turns up *one* strongly significant relationship – in fact, it is the only relationship that is significant at all. A coefficient of .448 (significant at the .000 level) was found between Performance and the pre-test PRO-SDLS inverted item 13: "I usually struggle in classes if the professor allows me to set my own timetable for work completion." As this is an inverted item (high responses replaced by low, etc.), you could read this as "the more the student agreed with the statement at the start of the semester, the more likely they were to fare poorly in the course," or "disagreeing with the statement was correlated with higher course performance."

Why item 13 and no others? It may point to a real relationship specific to online courses (in which time management skills can be an important success factor), or could be an artifact of this sample. This relationship must be confirmed or refuted in later work.

Relationships with Pre-Post Change In PRO-SDLS (Delta)

Delta scores were derived by subtracting pre-test PRO-SDLS from post-test PRO-SDLS, both overall and by item. Substituting the overall Delta score for the pre and post PRO-SDLS scores in Table 4, and computing new correlations, yields Table 5 below.

Table 5. Correlations between PRO-SDLS Delta and Other Primary Metrics in this Study

	Weighted Average	Effort	PRO-SDLS DELTA	Hours Spent per Week	Learning Activity Count
Weighted Average	r = 1.00	r =.181 sig =.166	r =.204 sig =.117	r =.159 sig =.224	r =.112 sig =.394
Effort	r =.181 sig =.166	r = 1.00	r =-.134 sig =.306	r =.296* sig =.022	r =.097 sig =.461
PRO-SDLS DELTA	r =.204 sig =.117	r =-.134 sig =.306	r=1.00	r =-.153 sig =.243	r =.109 sig =.409
Hours Spent per Week	r =.159 sig =.224	r =.296* sig =.022	r =-.153 sig =.243	r = 1.00	r =.068 sig =.607
Learning Activity Count	r =.112 sig =.394	r =.097 sig =.461	r =.109 sig =.409	r =.068 sig =.607	r = 1.00

We see that there are no significant correlations between the *change* in PRO-SDLS scores from start to end of semester with any of our other primary metrics. This study therefore provides no evidence that the change in student' perception of self-direction affected or was affected by course performance, learning habits or effort.

Looking into relationships between individual PRO-SDLS item deltas and our metrics, we found a few statistically significant correlations:

- The Performance metric (weighted course average) had statistically significant positive relationships with changes in item 1 ("I am confident in my ability to consistently motivate myself." r=.272, sig=.035) and item 12 ("I am very convinced I have the ability to take personal control of my learning." r=.363, sig=.004). The interpretation would be that there was a tendency for people who did well in the course to have improved their self-perception in these two areas.
- The Effort metric had a weak although statistically significant *negative* relationship with changes in the response to the inverted item 11 ("For most of my classes, I really don't know why I complete the work I do." r=-.281, sig=.030). This leads to the rather counter-intuitive interpretation that there was a tendency for students who put in more effort (as defined by our non-expertise extra credit items) to *agree* with the statement more at the end of the semester than at the beginning, implying perhaps that students do what they are told to do to get points.
- The *Number of Hours Spent* metric was found to have two statistically significant *negative* correlations with PRO-SDLS item deltas: Item 5 ("I always effectively take responsibility for my own learning." r=-.328, sig=.011) and Item 12 ("I am very convinced I have the ability to take personal control of my learning." r=-.262, sig=.043), implying that the greater the number of hours spent per week on the course, the less likely students were to increase their rating of themselves in these two areas. This might imply that finding that they had had to spend more time on the course (than they had anticipated) caused them to think less of their ability to control their own learning.

Conclusions

With regard to our first research question (*Can the PRO-SDLS, or some item(s) thereof, be used in a predictive or prescriptive mode in regard to future course effort or performance?*), the lack of a statistically significant relationship between pre-test PRO-SDLS and the weighted course average indicates that, at least for this course, the potential for using the PRO-SDLS pre-test instrument for predictive or prescriptive purposes is very limited. Only one individual pre-test

PRO-SDLS item was found to have a strongly significant relationship with the weighted courses average; further study will be needed to determine if this is a useful relationship or merely an artifact of this dataset.

Our second research question (*Are changes in perceived self-direction related to either performance or effort in a course?*) provides a less clear answer. We found a significant relationship between the post-test PRO-SDLS overall score and the Performance metric (weighted average). While this correlation (r=.284, sig=.028) is not a strong one, it stands in contrast to the lack of any significant correlation between the *pre-test* PRO-SDLS and the Performance metric. When, however, we looked directly at computed pre to post changes in PRO-SLDS total score, we found no statistically significant relationships with performance, effort or learning habits, except for a few individual item deltas. We must conclude that there is no definitive evidence to show any relationship between perceived self-direction and performance, effort or learning habits in this course.

We conclude that, for the purposes of this and very similar online courses, the effort and performance of students are largely independent of their perception of their self-direction. This does not answer the question of whether self-direction itself is irrelevant to student effort and performance in this type of course, for self-direction and students' perception of it may be different. This study certainly points the way to future work.

Future Work

This study suggests questions that should be addressed in future work:

- Are there specific components of courses (peer-learning implementations, for example) in which success might be predicted by perceived self-direction measures?
- This study used a dataset with an N of 60. Will replication of the study with a different or larger sample confirm the relationships that were found?
- For a larger sample, will partitioning the sample by student demographics reveal new relationships that have been "lost in the mix?"
- Would inclusion of other student demographics in a similar study reveal significant (and useful) relationships?
- Can we more directly (and objectively) measure students' self-direction? If so, what is its relationship to students' *perceived* self-direction over a semester and their performance in the course?

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