A Collaboration Case for Learning Empowerment

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Abstract
This research presents an alternative approach for assisting undergraduates to discover their learning strengths and to empower their learning abilities in a collaborative environment. Applying human performance technology (HPT), a tool to estimate human capital by defining the product of time and opportunity in performance, measures 37 undergraduates' competences for learning different software design techniques, especially when assigned to groups. The results indicate that HPT is effective for diagnosing undergraduates' potentials in a group design project context. In addition, it was suggested that the undergraduates should gain empowerment for identifying proper instructional learning needs and working productively in collaborative groups.

1. Introduction
The initial impetus for this research was to study empowering students' learning, and arose from a specific Windows Software Design course in a research-oriented university in the fall semester, 2007. By observation, apparently, most university teachers in software design courses tend to assign students to groups and then evaluate their collective performance. However, teachers seldom further consider how to help their students find their learning strengths in groups or provide proper learning support to the grouped students. In reviewing the literature, the connection between empowerment and collaboration has had frequent discussion [2, 6, 23]. Therefore, this research project begins an exploration of empowerment theory to discover methods to enhance the students’ group learning. Applying the concepts of Gilbert’s [22] human performance technologies (HPT) quantifies students’ collaborative performance during their learning empowerment processes.

This research assumes that students recognize their learning strengths in the process of learning with others and become effectively empowered to play proper roles in groups. In other words, the students can benefit from learning in association with others. In addition, learning support should be an aspect of the process of establishing a collaborative group setting.

2. Empowerment and collaboration
The subsequent discussion, in this section, provides the rationales for empowering individual learning strength based on the empowerment theory. Information from the literature review regarding encouragement of collaboration in groups, suggested methods to empower individuals. Prior research addressed HPT as being useful for identifying individual learning strength as well as for evaluating the performance of empowered individuals and collaborative groups.

2.1. Empowering individual learning strengths from collaboration
Empowerment theory often describes organizational characteristics, such as leadership, opportunity role structure, social support, and group-based belief system [10, 19]. Empowerment theory’s relevance to management theory and practice in organizations is also a common subject [10]. Most researchers adopt a constructivist paradigm to explore methods for learning empowerment. For example, Foster-Fishman et al. [20] used phenomenologically-driven interviews to capture personal empowerment experiences. With constructivism, these scholars stressed the importance of recognizing each person’s reality which is embedded in a particular context.

In addition, from psychological perspectives, empowerment consists of motivational processes as well as a motivational construct which means the existence of a belief in personal self-efficacy [10, 12, 21]. Similar to learning strength, Bandura’s self-efficacy notion [1] considered the possibility of strengthening an individual’s self-efficacy expectations through attainable outcomes and verbal encouragement. Power and control then become useful for describing the individual’s internal
motivational state [10, 16, 17, 19]. From most studies, obviously, contextual factors, such as supervisory style, reward systems and job design, are influential on levels of self-efficacy or learning strength [3, 10, 19]. Clark and Connelly [6] specifically stated that an individual’s learning power can be strengthened in a collaborative environment. Elizur [23] even created a three transactional mode construct (i.e., involvement, collaboration, and empowerment) for development of family-based care in a human-service agency. Other researchers arrived at similar conclusions regarding collaboration and individual learning strengths [2, 3, 5, 7].

2.2. Collaboration among empowered individuals in groups

Collaboration is a mutual engagement in solving problems [4, 8, 11]. Individuals, in a collaborative setting, have more opportunities to reflect on content knowledge or to build knowledge through social interaction which allows for effectively sharing different perspectives and responsibilities [9, 13, 15, 18]. Briefly, individuals become empowered in such collaboration, and collaboration can be effective in increasing the degree of an individual’s empowerment. In sum, empowered individuals, in groups, collaboratively share power when completing tasks [23].

“Empowerment facilitates commitment, creativity, productivity, satisfaction, and intrinsic motivation” [14, p. 1226]. Both at the individual and group (or organization) levels, empowerment processes can be facilitated [17]. For example, Meskill and Mossop [5] used technological tools providing socio-collaborative learning activities to empower individuals who were linguistic minorities. As a result, the individuals’ linguistic skills were socially and collaboratively built. On the other hand, at the group level, participative techniques can be used to promote friendship and communication, and then to encourage discussion, problem-solving and decision-making [7, 12]. Zimmerman [16] even regarded participatory action research as a method for exploring other collaboration empowerment issues.

2.3. Applying HPT to evaluate individual and group performances

Human Performance Technology (HPT) is a tool for evaluating the worth of a person’s performance. Gilbert [22] proposed “Leisurely Theorems” which contended that worthy human performance can be engineered and it represents human competence. In short, HPT is used to estimate human capital by defining the product of time and opportunity in performance. According to Gilbert, the expressions of three Leisurely Theorems are:

- $W = \frac{A}{B}$
  “Human competence is a function of worthy performance ($W$), which is the function of the value of accomplishments ($A$) to costly behavior ($B$).” (p. 18)

- $\text{PIP} = \frac{W_{ex}}{W_t}$
  “Typical competence is inversely proportional to the potential for improving performance (the PIP), which is the ratio of exemplar performance ($W_{ex}$) to typical performance ($W_t$).” (p. 30)

- $W = \frac{A}{(P + E) + (P * E)} = \frac{A}{(P + E + M)}$
  “For any given accomplishment, a deficiency in performance always has as its immediate cause a deficiency in a behavior repertory (P), or in the environment that supports the repertory (E), or in both. But its ultimate cause will be found in a deficiency of the management system (M).” (p. 76)

In this current research, worthy performance ($W$) refers to kinds of animated designs accomplished by students who took a Windows Software Design course. The expectation was that students would produce higher $W$ values without spending inordinate amounts of time or effort on designing a particular kind of animation. Integrating the concepts of empowerment theory with Gilbert’s HPT [22], highly competent students could produce $W$ values greater than 1.00, especially when assigning them into groups. In another word, the students would discover their learning strengths in this design course. Some students’ learning strengths could also be empowered in groups (P and E). Ultimately, a calculation of the average and the most outstanding performances among the students ($W_t$ and $W_{ex}$) would become apparent. In order to decrease the value of PIP for higher individual and group competencies, sufficient teaching support, appropriate inquiries, and the investigation included determining individual student’s prior knowledge about design concepts. The next section describes the methods adopted for the current research.

3. Research methods

With reference to empowerment theory, Bandura’s self-efficacy [1], and collaboration, the current research intends to discover ways to strengthen students’ learning abilities as both individuals and at group levels. By providing proper
support, students can feel empowerment in the process of learning different software design techniques. The following sections delineate the participants’ backgrounds and the research procedures. Human performance technology (HPT) was the measurement technique applied to individual student’s and groups’ performances.

3.1. Participants

All participants (37 undergraduate students, including nine females) were recruited in November 2007. Most of them (18) were in their sophomore year and majoring in Industrial and Information Management at the College of Management in a Taiwanese university. They demonstrated their personal Web sites to confirm that they had HTML design skills. Some students even had C++ or Java programming experience. Excluding few students (6) who did not sign the consent form, 37 undergraduate students were all successfully enrolled in an elective Windows Software Design course, and then were informed to collect their learning scores for participating this current research. All the students realized that no punishment should be made to their final scores if they decided not to participate or quit to participate in the middle of this current research.

3.2. Procedures

In the three hours per week Windows Software Design course, instruction of students mainly involved use of Macromedia Flash to develop interactive design effects. Students took the course in the fall 2007. Measurement of students’ individual and group performance occurred after completion of eight weeks.

From Weeks 1 to 4, the students received weekly design assignments on which their evaluations for performances in proficiency and creativity while using different design techniques for completing Macromedia Flash projects. The design techniques were: animated text, graphs, and motion clips. The relationships among Flash timeframes, layers, and scenes were introduced when using those techniques. Flash ActionScript commands and JavaScript language, also introduced in this course, were designed to help the students find their interests or explore learning strengths for later group project design assignments.

From Weeks 5 to 8, as teaching support, the students received two kinds of reading materials about design principles: usability and accessibility. Students received an introduction to game design ideas and examples of design experiences. Then, the students, assigned to one of six groups, had to determine an individual role to play in a group. These roles were: content provider, graphic designer, motion director, programmer, or project manager. Finally, the students completed an exam to determine how much they had learned from this design course, and whether or not they enjoyed the group work.

Overall, to empower the students in the process of completing individual design assignments and the final group projects, a diagnosis of the students’ learning needs occurred by reviewing HPT measurement results (described in the next section). A collaborative environment, intended for this design course, arose from encouraging students to interact with each other by using different technological tools, such as email, bulletin board systems and messaging.

3.3. Measurements

Gilbert’s [22] HPT analyzed a student’s competence in completing individual assignments. Worthy performance (W) was the main measurement for helping students to help students understand their learning strengths. After four weeks, the current research calculated five types of worthy performance. Subsequent to providing reading materials and assigning students to a group for role playing, the potential for improving performance (the PIP) was analyzed to compare competence levels of outstanding to average performances. Table 1 displays Windows Software Design course structure and its HPT measurement methods.

<table>
<thead>
<tr>
<th>Week</th>
<th>Teaching Content</th>
<th>Assignments</th>
<th>Learning Needs</th>
<th>HPT Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flash design tools, text and graphic design techniques</td>
<td>Create one animated text with at least three animated graphics</td>
<td>Clear explanations of Flash design templates</td>
<td>Individual scores on graphic/text design (Bg)</td>
</tr>
<tr>
<td>2</td>
<td>Flash Movie clip and button design</td>
<td>Create movie clips and then use buttons to control them</td>
<td>Know how to import high-pixel images into Flash</td>
<td>Individual scores on directing motion (Bd)</td>
</tr>
<tr>
<td>3</td>
<td>Introduction of Flash ActionScript commands</td>
<td>Use as many Scripts as possible in Flash different scenes</td>
<td>Provide Script examples</td>
<td>Individual scores on programming-Flash ActionScript (Bp)</td>
</tr>
<tr>
<td>4</td>
<td>Introduction of JavaScript language</td>
<td>Add an external link to Flash design</td>
<td>Provide JavaScript examples</td>
<td>Individual scores on programming-JavaScript (Bp)</td>
</tr>
</tbody>
</table>
performed better individually than they did in groups (Table 2, Table 3). Therefore, the values of the five types of worthy performance were lower than 1.00. Perhaps the students did not realize their learning strengths and only relied on their personal interests in selecting a role to play within their groups. Or, it was possible that the students needed more time for group discussions as well as increased encouragement to work collaboratively.

Table 4 displays the students’ potentials for improving performances (PIP) when playing different roles. The results show that the students playing a programmer role in the group had the greatest potential (PIPp = 1.41) to improve programming performance. In another words, the students had to spend more effort to achieve an outstanding performance in this function. Contrarily, outstanding performance was easier to achieve by playing the role of content provider in the group (PIPc = 1.18) than by playing the role of graphic designer, motion director or project manager.

4. Results

With reference to HPT, the students receiving the lowest scores in one particular assignment might receive the highest worthy performance value in the group. In this research, the 37 participants received an average of 89.47 points for all five assignments (average of Bg, Bd, Bpf, Bpj, Bc). The students

### Table 2. Students’ five types of worthy performance (obtained by each role)

<table>
<thead>
<tr>
<th>Types</th>
<th>Numbers of Students</th>
<th>Average Scores Obtained by Each Role in Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wg</td>
<td>10</td>
<td>89.17</td>
</tr>
<tr>
<td>Wd</td>
<td>9</td>
<td>87.58</td>
</tr>
<tr>
<td>Wp</td>
<td>7</td>
<td>75.49</td>
</tr>
<tr>
<td>Wc</td>
<td>6</td>
<td>86.64</td>
</tr>
<tr>
<td>Wm</td>
<td>5</td>
<td>88.12</td>
</tr>
</tbody>
</table>

### Table 3. Students’ five types of worthy performance (obtained by individuals)

<table>
<thead>
<tr>
<th>Types</th>
<th>Average Scores Obtained by Individuals</th>
<th>Values of Worthy Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wg</td>
<td>90.12 (Bg)</td>
<td>0.97</td>
</tr>
<tr>
<td>Wd</td>
<td>92.15 (Bd)</td>
<td>0.95</td>
</tr>
<tr>
<td>Wp</td>
<td>87.21 (avg. of Bp, Bpj)</td>
<td>0.87</td>
</tr>
<tr>
<td>Wc</td>
<td>88.38 (Bc)</td>
<td>0.98</td>
</tr>
<tr>
<td>Wm</td>
<td>89.47 (Avg. of Bg, Bd, Bpf, Bpj, Bc)</td>
<td>0.95</td>
</tr>
</tbody>
</table>

### Table 4. Different roles’ PIPs

<table>
<thead>
<tr>
<th>Types</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIPg</td>
<td>99.00</td>
<td>87.16</td>
<td>1.14</td>
<td>0.97</td>
<td>1.18</td>
</tr>
<tr>
<td>PIPd</td>
<td>98.60</td>
<td>87.58</td>
<td>1.13</td>
<td>0.95</td>
<td>1.19</td>
</tr>
<tr>
<td>PIPp</td>
<td>92.60</td>
<td>75.49</td>
<td>1.23</td>
<td>0.87</td>
<td>1.41</td>
</tr>
<tr>
<td>PIPc</td>
<td>100.00</td>
<td>88.64</td>
<td>1.15</td>
<td>0.98</td>
<td>1.17</td>
</tr>
<tr>
<td>PIPm</td>
<td>96.40</td>
<td>85.12</td>
<td>1.13</td>
<td>0.95</td>
<td>1.19</td>
</tr>
</tbody>
</table>

(1) Outstanding Scores Obained
In sum, the PIP value was helpful for determining how much effort students should expend when playing a particular role. The measure also encouraged students to enhance their learning strengths by working collaboratively on their group projects. In addition, all participants obtained 83.73 average points on the exam, which tested all design techniques. This result showed that the students had different learning strengths. They could perform better and have higher potentials for improving their performances if they selected the right role and worked collaboratively in their groups.

5. Discussions and limitations

The results of the current research, summarized as the following three points appear to be coherent with prior studies: First, individual performance could be more effective than group performance in some circumstances. Kernan, Bruning and Miller-Guhde [24] concluded from an experimental research that individuals performed significantly better than groups when given complex tasks with high supporting information. Due to shared responsibilities, group performances were similar to that of individuals during complex tasks and without any supporting information. The current research also indicates free-rider problems, concerning individuals, exist in groups. The results of many studies in education and business raised the same problems, and discussed ways to solve them [26, 27, 28, 29, 30]. In addition, Kragl [31] formulated a model to determine individual and group performances. Since the participants were regarded as envious individuals and the performance was non-verifiable in Kragl’s [31] research context, a suggested solution was to promise rewards as well as establish credible commitments for good performance for both individuals’ and groups’ incentive contracts.

Second, this research expected that the students could defer to their learning strengths to choose a proper role in their groups after completing different individual assignments. However, they still relied on their personal interests when choosing certain roles in their groups. This finding might be due to no significant difference among the students’ individual scores on different assignments. Based on Bandura’s [1] social cognitive perspective, the students in this research could still believe or have confidence in their competencies when executing their roles in completing group assignments. The significant self-efficacy effects on academic performances or career plans have been established in many prior studies [32, 33, 34, 35, 36, 37]. In the current research, since the students perceived positive experiences from completing the individual tasks before group assignments (i.e., when comparing their scores with others), they developed high self-efficacy [38] and relied on their personal interests when choosing roles they found interesting.

Third, the current research found that the greatest challenge for students in their groups arose from the role of computer programmer who writes Flash ActionScript and JavaScript. The PIP values showed that to become an outstanding programmer, the students achieving the average or ordinary performance when playing this role had to spend additional time or effort. This suggestion was supported when comparing different types of the worthy performance (i.e., Wg, Wd, Wp, Wc, Wm) obtained by each role in each group versus by individuals. In addition, when reviewing the students’ comments on playing certain roles for their group design projects in this elective course, most students very much appreciated the contributions made by computer programmes who played such important roles in their groups. However, this current research found that those programmers did not intend to take this course for enhancing their programming skills. Some of them even considered being programmers and spending almost half of their time in front of the computers was worthless to their lives. Many young people nowadays majoring in computer science or computer-related fields have the same thoughts to their career plans and living styles after they graduate from universities. Thus, many prior studies have predicted the need to deal with the increasingly significant IT shortage in the near future, especially in Europe and North America [39, 40, 41, 42, 43]. According to the literature, the reasons for the lack of qualified and skilled IT professionals vary. For example, the nature of IT learning content is, apparently, uninteresting to younger, entry-level employees unless salaries are high. Hiring an IT worker from another country may be less expensive, but skilled ones are difficult to find because of certain immigrant limitations, such as for Chinese IT workers.

In addition, the numbers of scholastic computer science programs are declining. Developing an appealing IT course that sparks students’ interest in working with computers is difficult. The students could easily be dissatisfied with course design after graduating from college or graduate schools since teachers are often unfamiliar with industry needs or
inexperienced with practical program design tasks. Besides, teachers usually offer the same IT content to all students regardless the need to update it after a period of time. Overall, the solution to the problem of a shortage of IT professionals, is in the findings of this research: Empower students’ learning strengths and have them work collaboratively in groups.

Finally, four limitations in this current research are worth mentioning. One limitation involves the grading policies adopted for the elective course. The punishment which deducts points for individual’s late or no submission restricted the accuracy levels for predicting each student’s learning strength. Besides, the students, especially Asian students, are expected to perform well on individual tasks, but not equally on their group tasks. They would also perform well in groups as long as the grading policies were fair or other assigned, individual tasks in other courses did not accumulate in the middle of the semester. That was also the reason the students performed better individually than they did in groups according to this research results.

Two limitations involve the complexity of the tasks assigned to the students individually and in groups, and the amount of teaching support the students received in the course. The literature review revealed that the complexity of the assigned tasks and the amount of teaching support had effects on performance [24]. In this current research, the complexity of individual tasks is indeed less than the group tasks. That is the reason most students perceived that they had competence to adopt the roles they found interesting. Some students even neglected the teaching support and preferred to independently complete tasks before and after they were assigned to group design projects. Hence, the students’ learning styles should also be also considered in this current research, such as having internal or external locus–of-control learning styles [25]. The students having internal locus-of-control learning styles would like to independently complete tasks.

The last limitation regards the group discussion time offered by the course. After the course, most students expressed the need to have more group discussion time. The time issue was not considered in this research and might have affected on group performance, since a few late submissions occurred toward the end of the time allowed for group projects. In brief, controlling for previous factors could have been influential in producing different research results.

6. Conclusions and implications for future research

This current research, based on the empowerment theory, explored students’ learning strengths in completing individual tasks and group assignments. Gilbert’s HPT was the basis for analyzing students’ competencies, worthy performances, and the potential for improving performance. As Seed [2] stated, a better way to re-examination individuals’ abilities for completing a task is to empower them and then to promote collaboration. The results of this research project found that the students were empowered by accommodation for appropriate learning needs and support and working in collaborative groups. In addition, the students found their learning strengths and were encouraged to perform well in groups.

A question remains as to whether or not students can be continuously empowered in a particular context. The intent of the next research project is to explore the extent to which students’ competencies remain over time. Future studies could also carefully describe the characteristics of each role played in each group. Students’ perceptions of working on group projects and taking responsibility for certain roles could also be included. In addition, the connection between Bandura’s self-efficacy and learning strength in empowerment theory could be explored further in a future study.

7. References


