ATLANTA
120th ASEE Annual Conference & Exposition
FRANKLY, WE DO GIVE A D*MN
June 23-26, 2013

Paper ID #6088

Prototype Exemplars: The Path to Effective Design or to Design Fixation?

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Prototype Exemplars: The Path to Effective Design or to Design Fixation?

Abstract

An investigation into the impact of the presence of a prototype exemplar in an introductory design experience is described. The design experience occurred early in an Introduction to Engineering course following a single lecture on the engineering design process. The design activity, necessarily simple at this stage, consisted of designing, building, and testing a drag racer, constructed from LEGO® MINDSTORMS® NXT parts and powered by a single rubber band. Students participating in the design experience were divided into two functional groups: laboratory sections where a prototype exemplar was present and laboratory sections where no example was provided. Assessment of the prototype exemplar impact was accomplished through a two-pronged approach. First, through photographs and performance data taken at multiple stages in the design experience and analyzed by the faculty, and second, through a twelve-statement survey given to all students. In addition to assigning numerical values (on a scale from 1 to 6) for their responses to the survey statements, students were asked to respond with short, written statements.

This study is in its second year. Survey results from the first year indicated similar backgrounds between control and exemplar groups as well as similar internal team interaction. First year survey results also indicated that the prospect of an example (control group) had greater value than the exemplar group valued the actual example.

At the end of the initial design phase and two subsequent redesign phases, photographic evidence was evaluated to determine the presence of five distinct features of the prototype exemplar: three of the features were functional and two features essentially cosmetic. While the primary purpose of the photographic evidence is to determine whether the presence of a prototype exemplar leads to better final designs or to student fixation on particular design features, the data will be evaluated to determine any correlations between feature presence and performance. First year photographic evidence proved somewhat inconclusive due primarily to inconsistencies in data collection procedures and inconsistencies in design constraint communication to the student groups. Second year improvements in each of those areas have been put into place.

I. Introduction

A study has been conducted to assess the effects of exemplar presentation to students prior to asking those students to engage in an engineering design exercise. Five sections of an Introduction to Engineering class were assigned the same laboratory design problem. In three of those sections, the students were presented with an exemplar solution at the beginning of the design process. In the other two sections (the control group), no exemplar was presented. In the sections with no exemplar, students were given no creative guidance and were simply presented with the design problem that they needed to solve. Students were told to apply the engineering design process and then left to their own creative efforts. In the exemplar sections, the students were allowed to see a common solution before being left to their own creative efforts. Student work was then assessed through measurement (by time trial) of each iterative step forward in the design process. At each time trial, each team's solution was photographed. At the conclusion of the laboratory period, students completed a survey instrument to provide feedback about their sources of intellectual contributions to their design.

It was theorized by the authors that presenting an exemplar prior to setting the students onto a design project could alter, if not hinder, the number and type of creative solutions generated by the students. Of particular interest is whether the presence of a prototype exemplar contaminates the design process for novice designers. That is, does the prototype exemplar cause novice designers to fixate on particular design features thereby limiting creativity or does it help them to improve the performance of their designs?

The concept of designers fixating on particular design features is not new to the study of engineering design. Jansson and Smith[1] were among the first who "clearly and repeatedly demonstrated the existence of design fixation" through a series of experiments using senior-level mechanical engineering students. Linsey, et.al.[2], demonstrated that fixation on design features extends to design professionals, even those (in particular, engineering design faculty) who are trained in and study engineering design. Chrysikou and Weisberg[3] conclude that fixation due to pictorial examples "is a general phenomenon that affects individuals irrespective of expertise." On the other hand, Purcell and Gero[4] contend the pictorial information has no effect if the instance was unfamiliar, but if familiar, pictures were found to produce both design fixation and increased variety in design. Perttula and Sipilä[5] have found a high correlation between positive design outcome and the commonality of examples presented when limiting the design experience to design idea generation. Viswanathan, et.al.[6] have compared the propagation of fixation due to poor and excellent examples.

This study varies from much of what is found in the literature in two basic areas: 1) the form of the example, and 2) the duration of the task. The example presented for inspection was a prototype exemplar: a fully functional physical item that was a solution to the design exercise, able to perform the design problem task. Further, the task extended through three full cycles of iterative design improvement and the extent of exemplar contamination of the resultant design was explored at each cycle. Zemke[7] has carried out design fixation study through two design-fabricate-test cycles.

The study is in its second year. The first year of the study[10] uncovered difficulties in the presentation of the design challenge particularly in time management during the laboratory period: two laboratory sections, one exemplar section and one control section completed only two of the three design phases in the first year. Design constraints, as presented by the laboratory instructors, varied sufficiently so that valid evaluation of the presence of design fixation and the comparison of performance between groups were deemed questionable. In the second year, corrective action was taken to alleviate each difficulty.

II. Background Information on the Course and Description of the Laboratory Challenge

In this section, a description of course and the laboratory challenge is provided. The University of San Diego is a Roman Catholic university in Southern California in the liberal arts tradition. The university offers three engineering majors in electrical engineering, industrial and systems engineering, as well as mechanical engineering. The three majors share a common curriculum in the freshman and sophomore years and students receive a dual BS/BA degree in unique 4.5 year programs.

Engineering design is incorporated into the curriculum of the three programs at all levels. Students are initially exposed to the engineering design process in the freshman year through the ENGR 101 (Introduction to Engineering) and ENGR 102 (Engineering Design Practice) courses. A design experience is integrated into many sophomore, junior, and senior engineering science classes and engineering design is an essential component in the senior capstone courses.

The Introduction to Engineering (ENGR 101) course consists of two hours of lecture and two hours of laboratory meetings per week. An honors section of the course (ENGR 101H) meets for an additional hour each week. The course is part of the University of San Diego's Preceptorial Program and it combines a regular course with topics intended to ease the students' transition into the college environment. Preceptorial courses are taught by experienced, full-time, tenure-track faculty and student enrollment is typically limited to about twenty students per class. The course instructor is also the initial academic advisor for the students. The Preceptorial Program should[9]:

1. *Introduce the student to the intellectual resources of the University*
2. *Encourage the student to develop the inquiring habit of mind that is fundamental to higher education*
3. *Assist the student in planning a cohesive and productive program of study*
4. *Provide for early and continuing communication between the student and the advisor.*

The laboratory component of the course is based on the LEGO® MINDSTORMS® NXT system. Students work on a variety of design challenges, including a rubber band powered racer, a shuttle race, a relay race, and a line follower. The duration of an individual challenge varies from a single week to four weeks. The challenges stress the use of the engineering design process and often include iterative improvement of an initial design.

The lecture component of the class at first complements the laboratory challenges. The course starts with an introduction to the engineering design process and programming basics of the

LEGO® MINDSTORMS® NXT system. The remainder of the semester covers engineering skills and Preceptorial topics. Engineering skills covered include data analysis and graphing with Excel as well as drawing skills (isometric drawings and projections created by hand and using ProgeCad software in some sections). Preceptorial topics include student advising, time management, exam preparation, as well as oral and written communication skills. The honors section of the class has an additional class meeting each week and covers additional topics, including library research, engineering ethics, sustainability, and global perspectives of the engineering profession.

This study of design contamination was performed as a part of the first laboratory challenge. This early placement was chosen because the engineering design process is covered in a lecture in the week preceding that challenge. This lecture and laboratory combination has previously been used to study the application of the engineering design process by novice designers[8]. All five sections of the Introduction to Engineering course taught in the fall 2012 semester participated in this study.

The first laboratory challenge is the design and construction of a rubber band powered racer by teams of three students. The racer is constructed solely from LEGO® MINDSTORMS® NXT parts and students have a chance to become familiar with the NXT parts, including structural elements, connectors, axles, gears, and tires. The programming interface, controller, sensors, and motors are not introduced until the lectures and laboratories that follow. The only energy source available to power the racer is a single rubber band. This challenge is structured to allow students to apply the engineering design process that had just been covered in the lecture component of the class.

The racer design challenge consists of three similar phases. During each phase, the teams work on their design for a specified period of time. A racer is built from scratch during the first phase and then improved during the second and third phases. The instructors of the classes are provided with a schedule in order to make the experience as similar as possible in the different course sections. At the end of each phase, the teams enter their racers into a competition with the measure of success being the distance covered by the racers. As the teams progress through the three stages, the requirements to obtain a certain grade level increase: In order to obtain the highest score, the racer must cover 10ft in the first phase, 20ft in the second phase, and hit the wall in the laboratory (just under 30ft from the starting line) in the third phase. In addition, the team with the highest performing racer in each design phase receives extra credit.

This procedure differs somewhat from previous years. First, a schedule was provided to all instructors in order to make the results between class sections more comparable. Second, the content of the three phases was changed. In previous years, student teams also build an initial version of the racer in the first phase and a competition based on distance was held (30% of the grade). In the second phase, students redesigned and improved their racers. Again, a competition was performed, but it was not part of the grade. In the final phase, students again redesigned and improved their vehicle. The final racers were evaluated for design features and aesthetics (30% of the grade) as well as distance covered in a final competition (40% of the grade). The distance required to obtain the highest grade was the same at each design phase in the past years.

Students in three of the five sections of the course, called exemplar sections, are shown an example of a successful racer built by students in a previous year (Figure 1). This particular racer was chosen due to some easily recognizable features, such as the arched body, the use of gears, or the differently sized front and back wheels. This racer was found to perform well and it reaches a distance of about 20ft. Hence, it is unable to obtain the highest grade in the third phase of the competition and students need to deviate from this design in order to reach the highest possible grade. The remaining two sections act as control group sections and the students are not provided with an example.

Figure 1. The prototype exemplar racer

The racers designed and built by student teams are then studied for design contamination using a variety of tools: First, pictures are taken of the designs to evaluate commonalities with the example provided by the instructor or other racers designed by students in the class. Second, the students are asked to complete a survey instrument to learn about their use of the engineering design process and their observations of racer features from the exemplar provided or racers built by other groups in the class. Third, students are encouraged to provide additional comments on the design challenge. Finally, the performance of the different designs is evaluated.

I. Assessment of Student Learning

In order to assess the impact of a prototype exemplar on design creativity, a two-pronged approach was used:

1. A survey, focusing on the design process, work distribution within a team, and student perceptions concerning the influence of the prototype exemplar (if applicable) and/or the influence of other student designs on a team's final design.
2. Photographs of the student racers were taken at the end of each of the three design phases and an analysis of the design progression through those photographs was performed by the investigators.

A. Survey-based Likert data

At the end of the laboratory meeting, students were asked to complete a short survey. Two different survey instruments were developed for the exemplar and control sections of the class. Survey statements related to the engineering design process, work distribution within a team of students, and the use of other teams' solutions are identical. Survey statements about an instructor-provided example racer, however, are different and aim to assess the actual usefulness of the example racer (exemplar group) or the potential usefulness of an example racer (control group).

Students in each section of the class were asked to score their agreement or disagreement with the twelve statements itemized in Table 1. In addition, they were asked to provide short answers to the questions included among some of the statements. Notice that eight of the twelve questions are identical for the exemplar and control sections. Questions concerning the presence of an example (questions 6, 8, 9, and 11) are slightly reworded to reflect the difference between exemplar and control sections.

Students used the following scale to score their agreement or disagreement with the statements:

1. Strongly Disagree
2. Disagree
3. Somewhat Disagree
4. Somewhat Agree
5. Agree
6. Strongly Agree

A Likert scale with an even number of levels was chosen to avoid a neutral rating and students had to either indicate agreement or disagreement with the statements.

A total of 112 students completed the surveys. Of these 67 students (59.8%) were in the exemplar (E) sections and 45 students (40.2%) were in the control (C) sections. The distribution of responses to the survey questions is shown in Table 2.

Both groups were trained in the same manner and reported a similar familiarity with the engineering design process (question 1) although the control group reported a slightly higher mean in response to the question (mean of 4.16 compared to 3.77). It is suspected that the introduction of a well-performed example racer with design features that not all students were familiar with had somewhat negatively influence student's self-evaluation of their engineering design knowledge. Both control and exemplar groups reported similar level of confidence in applying engineering design process, teamwork and idea generation during this exercise (questions 2, 3 and 4).

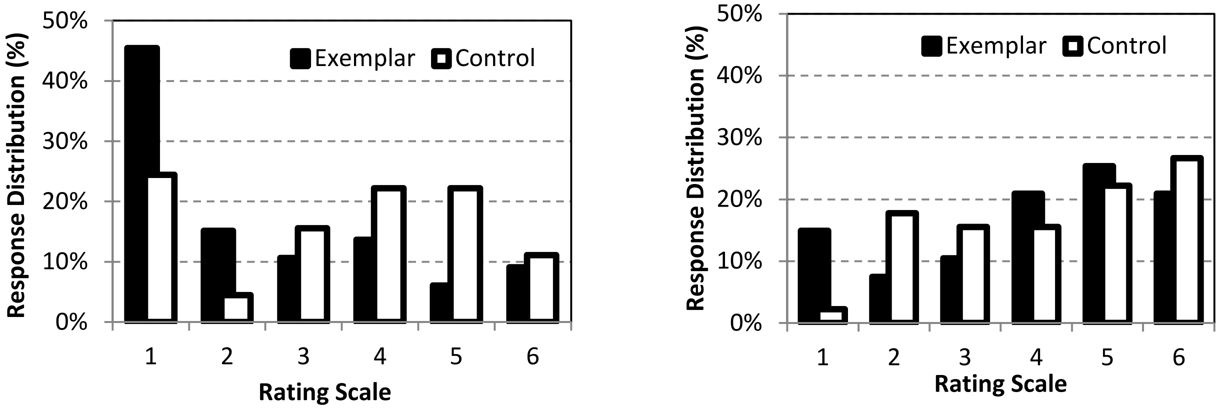
In the area of looking for outside help, almost twice the percentage of control students generally agreed that they looked at other teams' racers for help (55%) as compared to the students in the exemplar group (29%). However, there seemed to be a general consensus among the students that they had looked at or would like to look at an example racer during the exercise. Specifically, exemplar students broadly reported that that they looked at the example racer for help (67%), and a majority of the control students would have liked to look at an example (64%). The response distributions for those two questions (5 and 6) are shown in Figure 2.

Table 1. Survey questions

Exemplar Group Questions	Control Group Questions
1. I am familiar with the engineering design process. What are the main steps of the engineering design process?	1. I am familiar with the engineering design process. What are the main steps of the engineering design process?
2. I felt confident in applying the engineering design process during this exercise. Which steps did you feel most/least confident about?	2. I felt confident in applying the engineering design process during this exercise. Which steps did you feel most/least confident about?
3. I came up with many ideas on how to build the racer. What did you contribute to the design of your racer?	3. I came up with many ideas on how to build the racer. What did you contribute to the design of your racer?
4. My partner came up with many ideas on how to build the racer. What did you partner contribute?	4. My partner came up with many ideas on how to build the racer. What did you partner contribute?
5. We looked at other teams' racers for help. What ideas did you take from another team?	5. We looked at other teams' racers for help. What ideas did you take from another team?
6. We looked at the example racer for help.	6. I would have liked to have an example racer for help.
7. I prefer to come up with my own ideas for the design of the drag racer.	7. I prefer to come up with my own ideas for the design of the drag racer.
8. It is helpful to look at an example or prototype.	8. An example or prototype to look at would have been helpful.
9. Looking at an example racer improved our design.	9. Having an example to look at would have improved our design
10. Looking at the other teams’ racers improved our design.	10. Looking at the other teams’ racers improved our design.
11. Looking at an example racer decreased the need for original ideas.	11. Having an example to look at would have decreased the need for original ideas.
12. Looking at other teams’ racers decreased the need for original ideas.	12. Looking at other teams’ racers decreased the need for original ideas.

Table 2. Survey Response Distribution

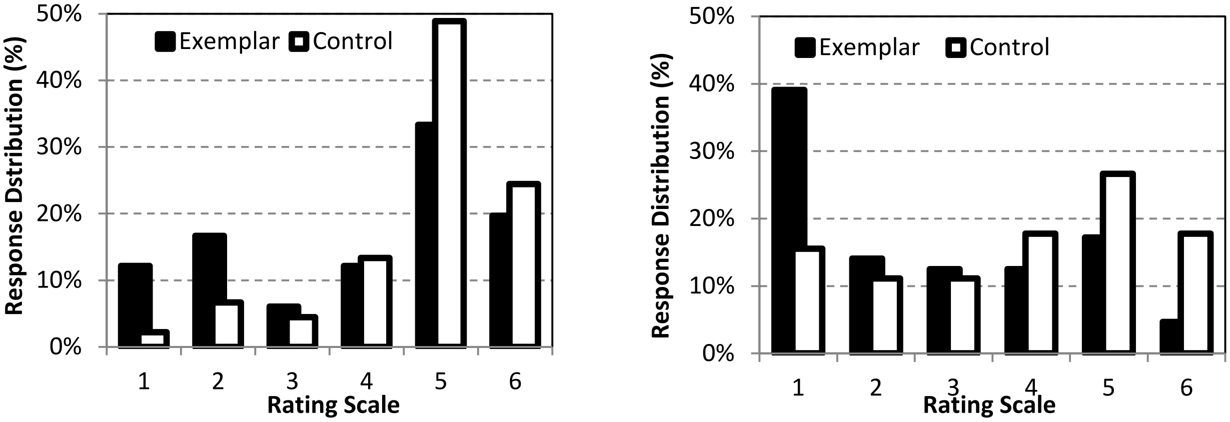
Response Distribution in %	Group	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree	Mean	Standard Deviation
1. I am familiar with the engineering design process.	E	4	18	11	36	23	8	3.77	1.32
	C	0	9	6	51	27	7	4.16	0.98
2. I felt confident in applying the engineering design process during this exercise.	E	6	8	21	33	25	7	3.87	1.27
	C	0	6	27	29	29	9	4.07	1.10
3. I came up with many ideas on how to build the racer.	E	5	3	9	24	43	16	4.48	1.22
	C	4	9	7	35	27	18	4.24	1.33
4. My partner came up with many ideas on how to build the racer.	E	2	6	6	15	45	26	4.74	1.19
	C	7	2	4	18	42	27	4.67	1.35
5. We looked at other teams' racers for help.	E	45	15	11	14	6	9	2.47	1.71
	C	25	4	16	22	22	11	3.47	1.73
6. We looked (would have liked to look) at the example racer for help.	E	15	8	10	21	25	21	3.97	1.70
	C	2	18	16	16	22	26	4.18	1.54
7. I prefer to come up with my own ideas for the design of the drag racer.	E	1	11	15	23	17	33	4.42	1.44
	C	7	4	14	23	25	27	4.36	1.48
8. It is helpful (would have been helpful) to look at an example or prototype.	E	0	4	3	17	32	44	5.08	1.07
	C	2	7	13	16	33	29	4.58	1.34
9. Looking at an example racer improved (would have improved) our design.	E	12	17	6	12	33	20	3.97	1.73
	C	2	7	4	13	49	25	4.73	1.21
10. Looking at the other teams' racers improved our design.	E	39	14	13	13	17	4	2.69	1.70
	C	15	11	11	18	27	18	3.82	1.72
11. Looking at an example racer decreased (would have decreased) the need for original ideas.	E	15	18	34	12	15	6	3.12	1.44
	C	4	4	14	18	29	31	4.56	1.41
12. Looking at other teams' racers decreased the need for original ideas.	E	31	27	17	9	11	5	2.56	1.52
	C	13	11	31	23	13	9	3.38	1.45



(a) (b)

Figure 2. Obtaining help from other sources: (a) Other teams (b) Example racer

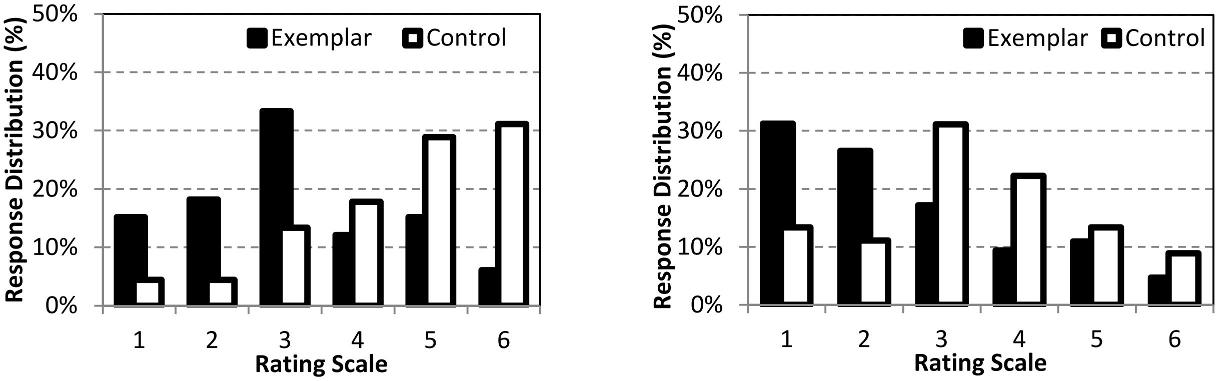
Although both groups expressed their strong preferences to come up with their own design ideas (question 7, mean of 4.42 rating for exemplar group compared to 4.36 rating for control group), the control group consistently stated that more design ideas, by looking at either the example racer or other team's racers (would have) improved their design (questions 9 and 10). The response distribution for questions 9 and 10 are shown in Figure 3. This data indicates that the control group indeed needs more alternative ideas to help with their designs. However, exemplar group found it more helpful to look at the example racer than the control group, by a margin of 15% (question 8). It is possible that the control group did not know what to expect to see in the example racer, therefore was less certain on how helpful the example would be for their designs.



(a) (b)

Figure 3. Sources for design improvement: (a) Example racer (b) Other teams

The final two questions dealt with whether the example racer or the presence of other teams' racers reduced the need for originality. Here the exemplar students distinctly felt that either type of outside influence did not decrease the need for original ideas: 67% generally disagreed that the example racer reduced the need and 75% generally disagreed that other teams' racers reduced the need. The control students, with only the other teams' racers present, seemed to think examples distinctly reduced the need for originality: 78% generally agreed that an example racer would have reduced the need for originality and 45% generally agreed that the other racers reduced the need. The response distributions for those two questions (11 and 12) are shown in Figure 4.



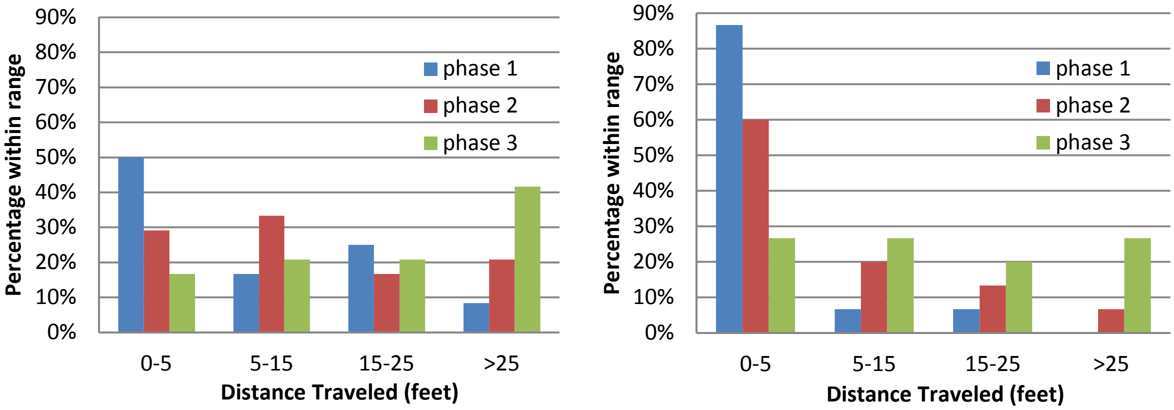
(a) (b)

Figure 4. Decreased need for original ideas due to: (a) Example racer (b) Other teams

C. Analysis of performance and photographic evidence

The single design goal of this laboratory exercise was "to design and build a LEGO® vehicle that travels the greatest distance when powered only by a rubber band." The scoring was constructed so that at each succeeding design phase the racer performance expectations were increased: maximum scores (30 points in each design phase) were achieved with a minimum distance traveled of 10 feet, 20 feet, and "hit the wall" (just under 30 feet) at each design phase, respectively. The exemplar, without modification, was capable of traveling about 20 feet, depending on the particular rubber band used and how it was wound, thus modifications to the exemplar were necessary in order to achieve maximum scoring. Ten (10) additional points were assigned for design esthetics.

Racers designed in the exemplar groups performed, in general, significantly better than those in the control groups at every design phase (Figure 5). At the end of the first design phase, 43% of the exemplar group racers achieve maximum scores (traveling ten feet) as opposed to 7% of the control group racers: one (4%) of the exemplar racers traveled the maximum distance and "hit the wall." On the other end of the scale, 87% of the control group racers traveled less than five feet as compared to 50% of the exemplar racers. At the end of the second design phase, doubling the performance requirement (to twenty feet) reduced the number of exemplar racers achieving maximum scores to 29% while 7% of the control group racers achieved that score: five (21%) exemplar racers and one (7%) control racer "hit the wall." The percentage of racers traveling less than five feet in phase two was reduced to 60% in the control group and 29% in the exemplar group. The final design phase saw another increase in performance requirements (to almost 30 feet – the "wall"). However, both groups saw an increase in the percentage of racers achieving maximum scores: 38% for the exemplar group and 27% for the control group. The percentage of racers traveling less than five feet continued to drop: to 27% for the control group and to 17% for the exemplar group.



(a) (b)

Figure 5 Racer Performance at Each Design Phase
(a) Exemplar Group Performance
(b) Control Group Performance

All performance data suggests that the presence of an exemplar allowed students to start with a better-performing design and continue to have better designs throughout the design exercise even though the prototype exemplar presented was not capable of meeting the highest level of performance required in the final design phase.

Photographic evidence was chosen as the primary path to explore evidence of design fixation. Photographs of the racers were taken at each design phase and examined after the completion of the design exercise. In order to measure the impact of the exemplar on the various designs, seven prototype exemplar features were chosen as characteristics that could be followed through the design phases as a measure of the level of fixation:

1. LEGO® figure as the "driver"
2. Arched frame – that is, one that is high in the middle
3. The presence of a "anti-wheelie" device
4. Rubber band disengagement
5. Large drive wheels
6. Small front wheels
7. Gears in the drive train

The last two features were further subdivided:

a. Narrow small wheels (as the exemplar) or fat small wheels
b. A single pair of gears (as the exemplar) or multiple stages of gearing.

The control group was also examined for these features as a comparison.

In the first round, one would expect that some of the control group teams would experience significant difficulty in producing (Figure 6). However, it also appears that some of the exemplar group teams had similar difficulties (Figure 7). None of the first-round racers from either group exhibited more than five of the chosen seven exemplar features with the exemplar group averaging 3.33 features while the control group averaged 2.00 features. By the final round the exemplar group averaged 3.5 features while the control group averaged 2.29 features

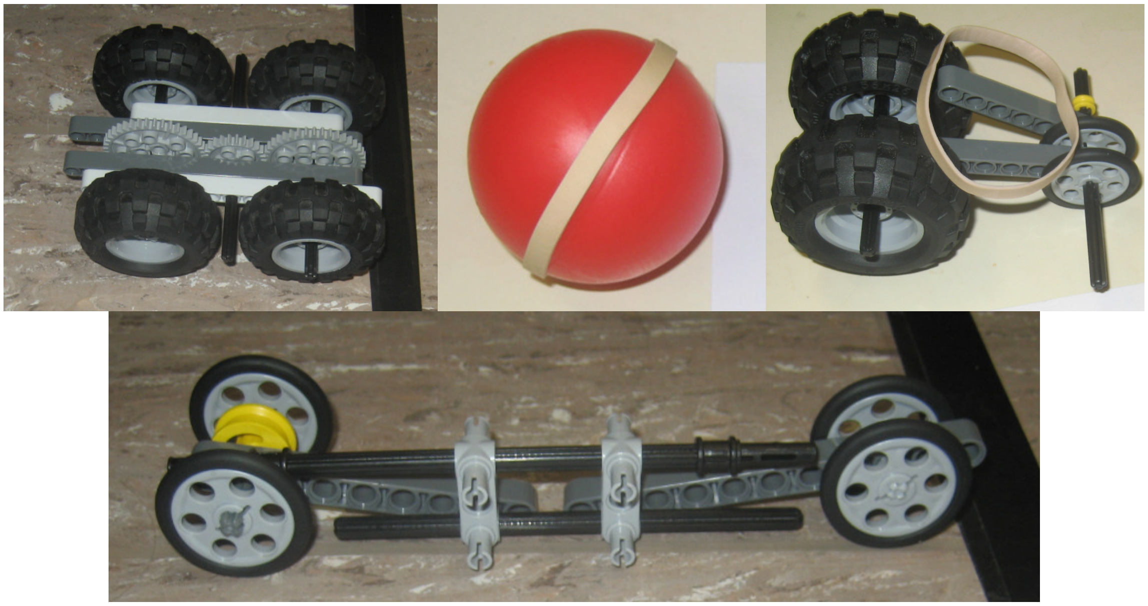


Figure 6 Selected Control Group Racers with Low Performance

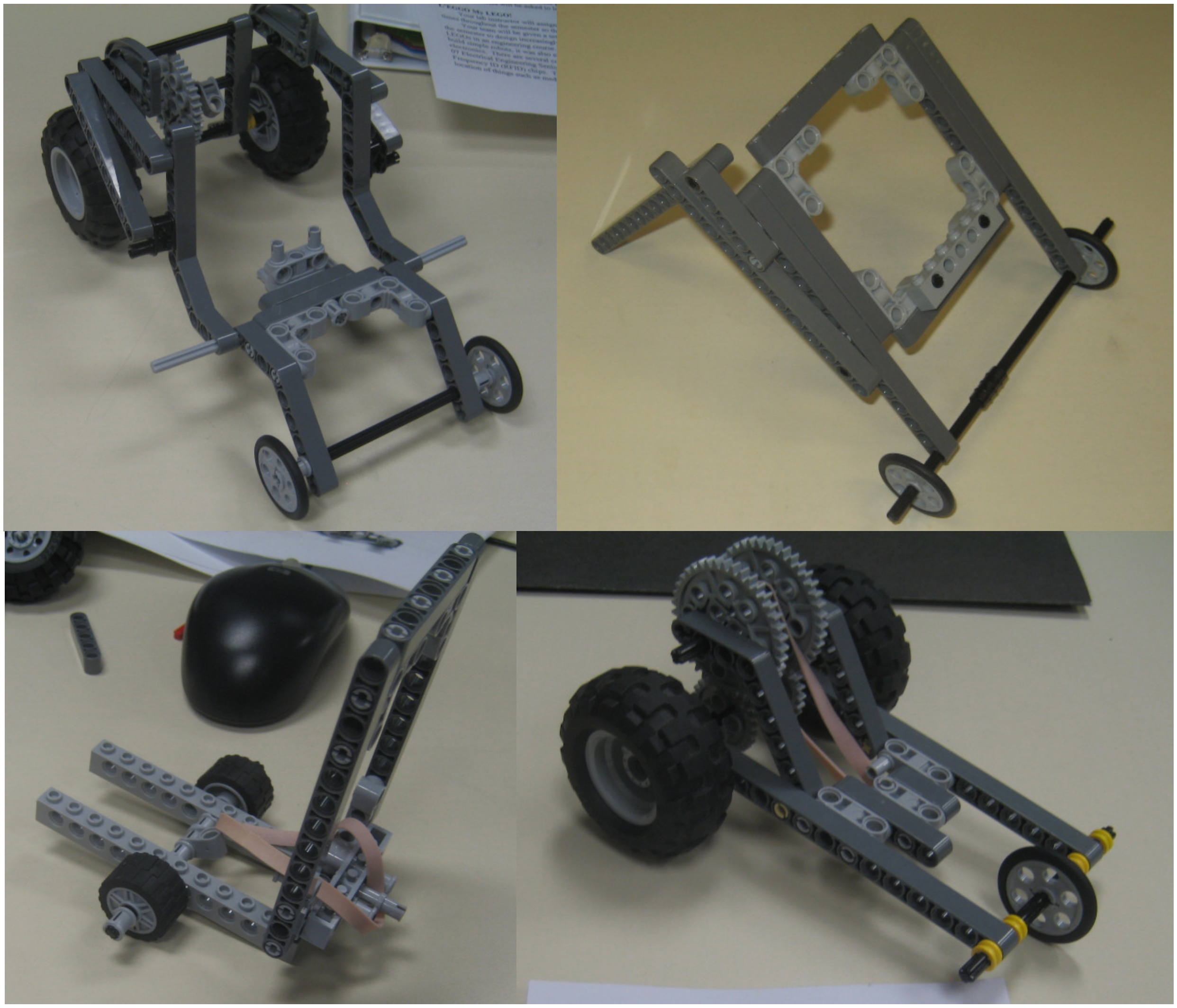


Figure 7 Selected Exemplar Group Racers with Low Performance

Of the seven chosen design features, there were clear differences between the exemplar and control groups for only two features:

- Large drive wheels (Figure 8)
- Gears in the drive train (Figure 9)

Large drive wheels dominated the exemplar group racers ranging from 92% in the first design phase to 100% in the final phase: in the control group, large drive wheels accounted for 33% of the racers in the first phase increased to 47% in the final phase. Similarly, gears in the drive train appeared in 42% of exemplar racers in all phases with a slight increase in the number with multiple stages of gearing at the second stage. The control group started with 13% of racers with multiple-stage gearing only and shifted downward to 4% (1 racer) with only single-stage gears in the final design phase.

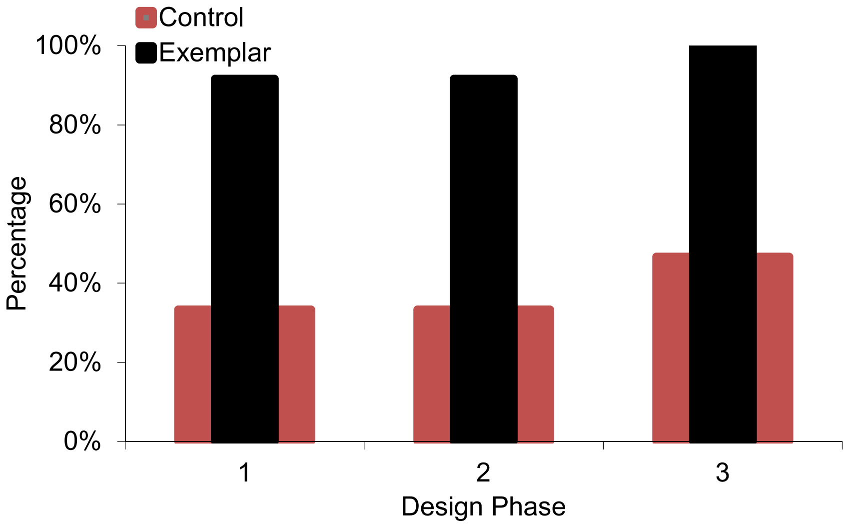


Figure 8 Presence of Large Drive Wheels at Each Design Phase

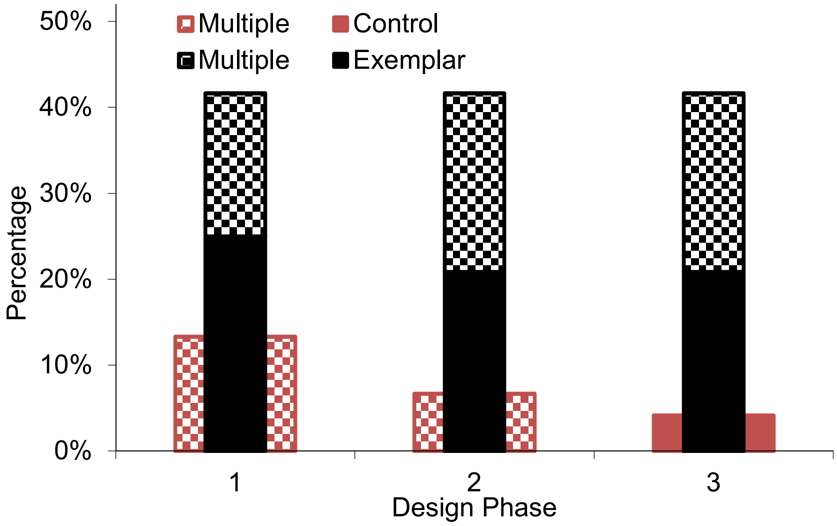


Figure 9 Presence of Gears at Each Design Phase

Two of the selected design features showed lesser evidence of design fixation:

- Arched frame – that is, one that is high in the middle (Figure 10)
- Rubber band disengagement (Figure 11)

Three times as many exemplar racers (21% to 7%) as compared to the control racers began and ended the design phases with arched frames. Interestingly, in the second design phase the difference narrowed to 17% to 13%. Five time as many exemplar racers (79% to 15%) had a mechanism for disengaging the rubber band in the first design phase. All groups quickly noticed that this feature was essential to good design and there was no significant difference in the groups in the second and final design phases.

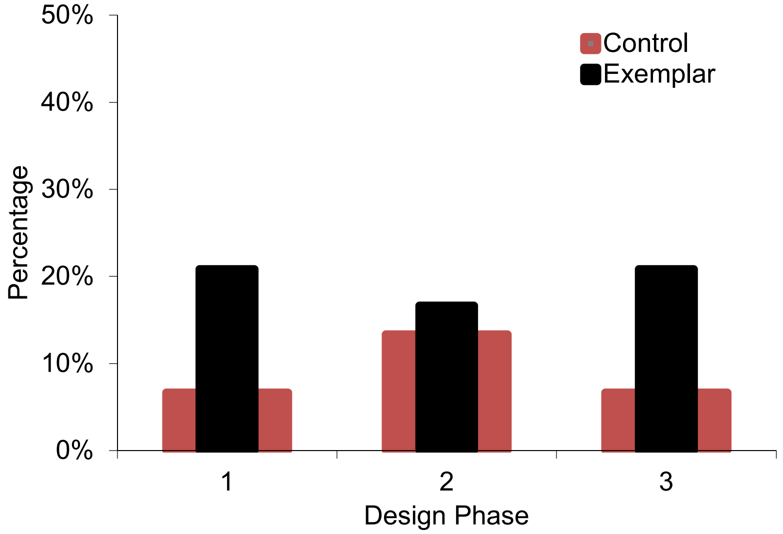


Figure 10 Presence of an Arched Frame at Each Design Phase

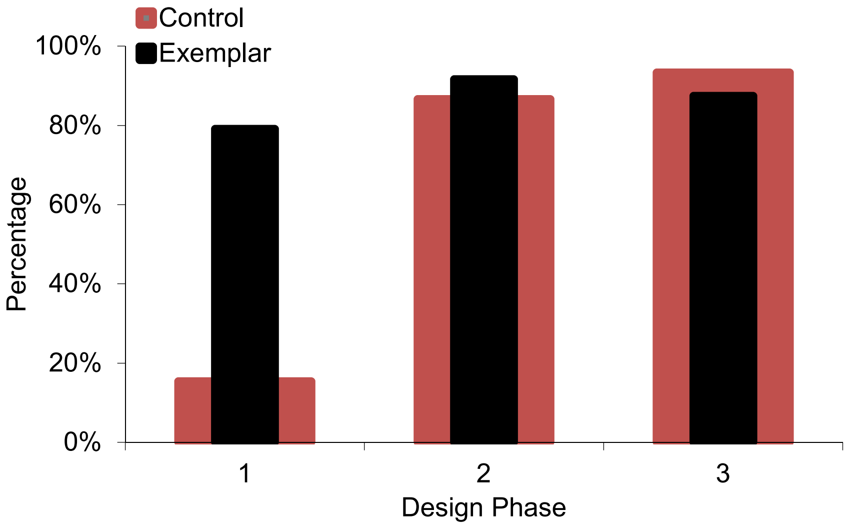


Figure 11 Presence of Rubber Band Disengagement at Each Design Phase

The final three design features:

- LEGO® figure as the "driver" (Figure 12)
- The presence of a "anti-wheelie" device
- Small front wheels (Figure 13)

showed no significant difference between the groups. In spite of some of the racers lifting front wheels at the start, no racers from either the exemplar or control group implemented an "anti-wheelie" feature in their design at any phase. While the exemplar group started with more than twice as many LEGO® drivers (17% to 7%), the final design phase saw 40% of the control group having drivers while only 29% in the exemplar group. The exemplar group used a few more small front wheels in the initial design phase (80% to 67%), but each phase saw a decrease in the difference with both groups at 67% in the final design phase.

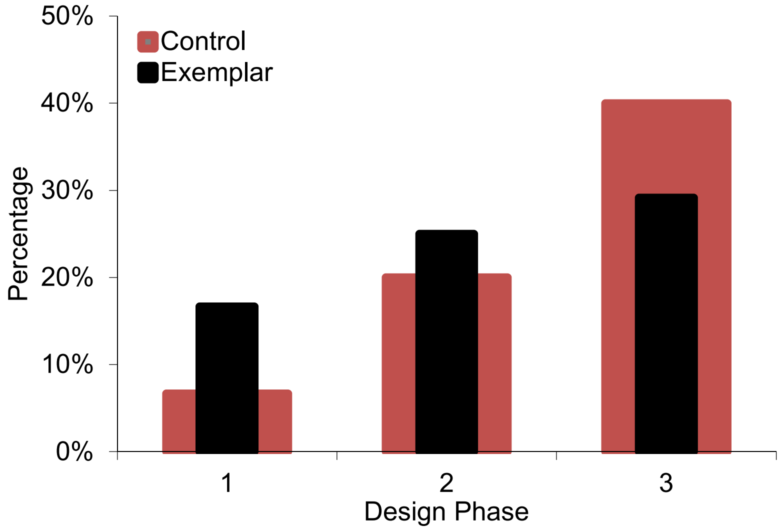


Figure 12 LEGO® "Driver" at Each Design Phase

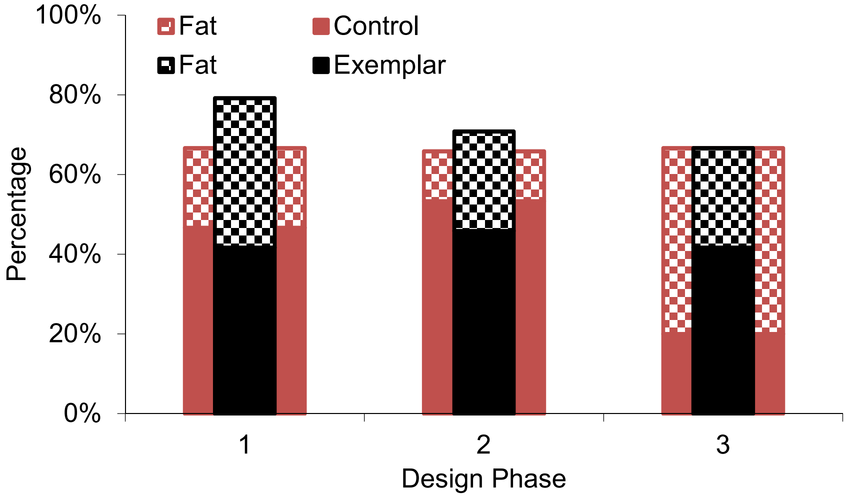


Figure 13 Small Front Wheels at Each Design Phase

The most successful exemplar racers, those that "hit the wall", showed wider diversity of design (Figure 14) than the most successful racers from the control group (Figure 15). None of the most successful racers from either group resembles the prototype exemplar.

Figure 14 Sampling of the Most Successful Designs from the Exemplar Group

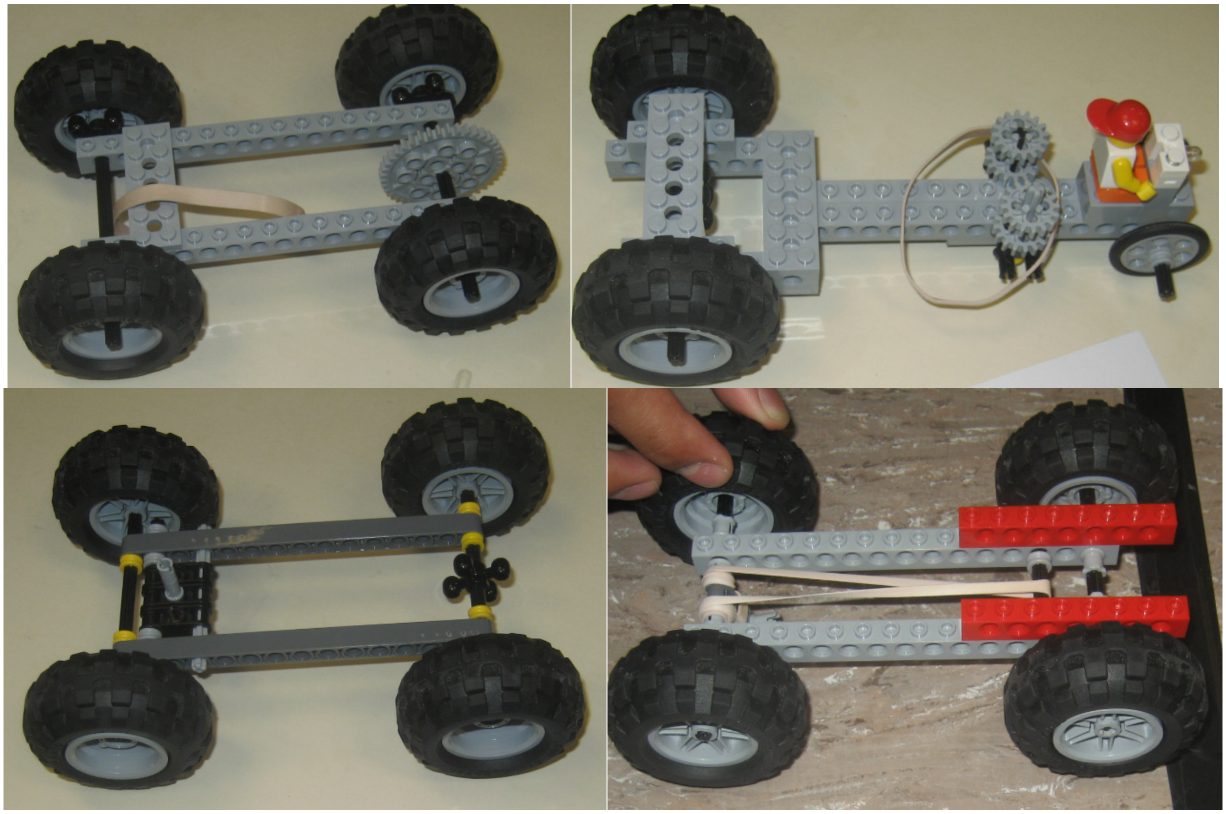


Figure 15 All of the Most Successful Designs from the Control Group

IV. Summary and Conclusions

The impact of a prototype exemplar on design performance and design fixation is studied in five sections of a freshman Introduction to Engineering course in the fall 2012 semester. After an initial lecture on the engineering design process in the previous week, teams of three students designed and built a rubber band powered racer. Students in three laboratory sections were provided an example solution, while the remaining two sections formed the control group.

In order to gain a more quantitative understanding of design contamination, students were asked to complete a short survey at the end of the laboratory meeting. Two different survey instruments, differing only in the wording concerning the presence of a prototype exemplar, were developed for the exemplar and control sections of the class.

The survey data showed that the students in both exemplar and control groups had similar knowledge about and confidence in using the engineering design process and had similar group dynamics concerning the generation of design ideas. Both groups strongly sought outside sources for ideas. The presence of an example reduced the need for the exemplar group students to seek ideas from other student teams' solutions. Similarly, the control group reported outside sources, either from other teams or from the prospect of an example, to decrease the need for original ideas, while the exemplar group reported the opposite opinion that outside sources did not decrease the need for original ideas. Both groups reported a general preference with coming up with their own design ideas.

It appears that the main impact of a prototype exemplar in this design exercise was a jump start to the design process. The control group performance level at phase 3 of the design exercise was quite similar to the performance level of the exemplar group at phase 2: approximately one design phase, out of three, behind. The level of diversity of design features between the two groups appears similar, hence the study did not see evidence of a difference in design fixation between the exemplar and control groups.

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