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Project Modulus: A study of Student Carryalls at Worcester Polytechnic Institute

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Project Modulus

A Study of Student Carryalls at Worcester Polytechnic Institute
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A study of Student Carryalls
at Worcester Polytechnic Institute

Interactive Qualifying Project Report completed in partial fulfillment
of the Bachelor of Science degree at
Worcester Polytechnic Institute, Worcester, MA

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Date: March 26, 2018

Report Submitted to:
Professor Leslie Dodson
Professor Curtis Abel
This six-month team project analyzed the items WPI students carry on a daily basis, their justification for doing so, and carry weight. We researched musculoskeletal hazards, as well as how specific items enable a student to complete specific tasks or maintain a preferred lifestyle. Student backpacks and bags were analyzed using focus groups, unstructured interviews and Everyday Carry photo documentation methods. Our findings can be used to reconsider and re-design backpacks based on a student’s major, gender and avocations.
We would like to thank our advisors, professor Curtis Abel and Professor Leslie Dodson for their guidance and support through all stages of this successful project. Additionally, We would like to thank Laura Robinson for supporting us through our background research phase and Gabriel Johnson for helping us through the IRB application. Our group would also like to thank all individuals who participated in our study for their time and contribution to this project.
The belongings a person carries are synonymous with what they do and who they are, and this study aims to explore that unique development. Students at Worcester Polytechnic Institute (WPI) were chosen to be the target research demographic and are the participants in this study. This study explores three key concepts related to student carrying culture. First, we investigate the type and number of the items that WPI students carry. Second, we study how each of these items enable the individual to perform and complete certain tasks. Third, we explore how the items that students carry enhance or limit their lifestyle choices. Through this research, we hope to bring to the attention of students, school administration, backpack designers, doctors and physical therapists issues we feel are overlooked. We also hope our work will be used in future studies to improve the lifestyle and self-expression of WPI students.
At WPI, students often find themselves involved in more avocations than just being a student. Extra curricular activities, honor societies, work, play, health and hobbies are just some of the few things that take up a student’s time outside of studies. However, in order to accomplish these tasks that make the individual more than just a student, one may need to carry enabling items. Such items allow an individual to complete a certain task they may struggle to complete or not be able to complete without said item. This study explores the idea that our carryalls are more than just bags to carry utilitarian tools. They have the ability to affect our physical and mental health, help us live our desired lifestyles and express ourselves.

There are numerous facets involved in university student lifestyle. By definition, lifestyle is the habits, attitudes, tastes, and finances, that together constitute the mode of living of an individual or group (Collins, 2018). Essentially, lifestyle is an expression of the individual. A student’s daily choices dictate attributes such as time allocation and involvement, which impacts certain lifestyle variables such as recreation, diet, exercise, and sleep among others and vice versa. These lifestyle variables are expressed in the everyday items that a student may carry with them. The amount, type, frequency and significance of things they carry can directly impact the health and wellbeing (Farhud, 2015) and academic performance (Wald et al, 2014) of the student, as well as their self expression (Han, et al.).
To explore the effects of carryalls on student lifestyle, we used three different methods across a group of students. This was done in order to find correlations between the amount, type, frequency of items student carryalls and their demographics as well as acquiring a deeper insight into student’s thoughts regarding what they carry. A demographic survey was used to acquire simple identifying parameters for each individual student. This information includes the individual’s graduation year, major area of study as well as minors and other majors, their identified gender, whether or not they live in WPI on-campus housing or private housing.

The Everyday Carry (EDC) photo documentation technique is a popular social media phenomenon (EDC.com, 2018). The original idea behind EDC photos was to creatively share the items an individual carries in their pockets. We expanded the use of the EDC tool to use it to conduct a photographic survey of all non-private items that individual WPI students carry in their backpacks. We chose this method in order to collect a broad array of data on types and amount of items in student’s backpacks. Throughout the study we employed the use of unstructured interviews while obtaining data on demographic surveys and EDCs of students.

Focus groups were chosen to stimulate discussion among participants in order to obtain in-depth information on student lifestyles. We sought out personable anecdotes on what students struggle the most with in regards to carrying, why they carry what they carry, and what they wish they could carry. This was done while guiding the group discussion toward the relationship between carry solutions and self expression.
Self expression can be defined as the displayed expression of one's own personality or the assertion of an individual’s traits. Many of the items carried in the participants' backpack are carried to enable them to be more than just students. These and other similar items enable students to self express and are vehicles and tools from which they are able to do so.

Individuals expressed a strong need for compartmentalization. Many of the items that were taken out of the bag had their own space within the backpack. However, the backpacks had less specific compartmentalization and often certain compartments were repurposed to hold multiple different items.

Redundant items, or items that appeared more than once in an EDC, were also present and offer some valuable insight. The main reasoning why students carried multiples of an item were for self-expression and ‘just in case’ insurance purposes.

From the focus groups, we found many common themes and trends. There were numerous comments that pertained to how heavy and painful some backpacks were.

We provide recommendations to students, school administrators, backpack designers and healthcare providers.
It is very challenging to identify the exact authorship for each individual section. This is mainly due to the fact that each section was revised multiple times, and in some cases its contents changed entirely or moved to other sections. To further explain this we will detail the process of completing this report in this section. First, each section was assigned to one or two group members to come up with an outline and write the primary draft. Then, another other group member revised it in order to ensure that the section is clear to someone who has never read it before. The secondary author then suggested edits on the content and structure of the section. Finally, the entire group as whole read the section and resolved the comments. This way the primary authors and the editors had a chance to clear up any complex issues or misunderstandings. Due to this process, the text written by the primary author often got changed entirely or moved to other sections making it difficult to generate a conventional authorship page.
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Introduction
The items a person carries are synonymous with what they do and who they are

This study aims to explore that connection. University students at Worcester Polytechnic Institute (WPI) were the target research demographic and are the participants of this study. At WPI, students often find themselves involved in more activities and avocations than just being a student. Extra curricular activities, honor societies, work, play, health and hobbies are just some of the few things that take up a student’s time outside of studies. However in order to accomplish the tasks that make the individual more than just a student, one may need to carry more enabling items with them. Enabling items are items which allow an individual to complete a certain task they may struggle to, or not be able to complete otherwise. Similar to how books enable a student to study, and a pencil enables a student to write, running shoes can enable a student to exercise and paint can enable an individual to create art.

Most often, students store items they would need through the day in order to express themselves as more than a student. A common form of storage is a backpack. Unfortunately, a backpack is only capable of providing a finite amount of storage space. This study explores the idea that our carryalls are more than just bags to carry utilitarian tools; they have the ability to affect our physical and mental health, help us live our desired lifestyles, and reflect who we are as individuals. For the purposes of this study, we define an individual’s lifestyle by the way the individual lives, what their hobbies are, what they eat, what their major field of study is, what their daily schedule is, the activities they partake in and any other aspects that make up an individual’s way of life. Self expression is defined as the expression of one’s own personality or an assertion of one’s individual traits. This can also be expressed as what an individual likes or dislikes, what their personality is and how they interact with their daily events.
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Fig 1: A student’s carryall can act as the connecting medium between lifestyle, self-expression and mental and physical health of a student.

Figure 1 shows that the carryall sits at the intersection of health, lifestyle and self-expression. By providing access to certain items during the day, the carryall enables individuals to participate in actions that directly affect each of these three main areas.
Methods
The research objective of this project is to examine the relationship between a college student's self-expression through their daily routines and the frequency, characteristics, and significance of the items they carry in their backpacks.

What trends can be identified, related to the backpack weight and the items inside it, across different demographics of students?

How does a student pick what they will carry in their backpacks and or pack their bags?

Does physical inability to carry necessary items limit a student’s desired self-expression especially in realms of personal, physical, academic, and avocational expression?
Sampling

All participants were WPI Undergraduate students. Participants were chosen based on convenience sampling. Locations of convenience sampling were at high traffic areas across the WPI campus such as the Campus Center, class buildings, or the library. Participants were approached and asked if they were comfortable removing the contents of their backpack and were asked to sign a waiver allowing a team member to photograph the backpack along with what is inside. Only a single group member would conduct a study with a participant in this way. Participants names were not associated with the photos of their backpacks.

Demographic Survey

Participants in our study were surveyed for demographic information. This information includes the individual’s graduation year, major area of study as well as minors and other majors, their identified gender, whether or not they live in WPI on-campus housing or private housing. These surveys took place prior to the unstructured interview in a verbal form. This information was written down on a notecard and then transferred online to the drive.
Every Day Carry
Photo Documentation

The Everyday Carry (EDC) photo documentation technique is a popular social media phenomenon (EDC.com) that is commonly seen on platforms such as Reddit, Instagram and Facebook. The original idea behind EDC photos was to creatively share the items an individual carries in their pockets. This allowed individuals to note interesting differences between avocations as well as noteworthy and unusual items that were being carried. We expanded the use of the EDC tool to use it to conduct a photographic survey of all non-private items that individual WPI students carry in their backpacks. We chose this method in order to collect a broad array of data on types and amount of items in student’s backpacks.

The steps of the EDC are as follows:
1. Students were asked if they are willing to participate in our study
2. Students who were willing to participate were asked to sign a waiver, declaring their willingness to become participants as well as their anonymity
3. The participant’s bag was weighed, and the weight of the backpack were recorded
4. The contents of the participant’s backpack were removed individually and laid out on a surface such as a table such that all individual items could be distinguished from each other
5. If a participant was unwilling to display or remove an item then they were permitted to leave the item outside of the study
6. A photo of the contents of the backpack was taken from a bird’s eye view
7. An unstructured interview occurred where the participant was asked about specificities about items in the backpack
8. Demographic data was collected and stored online in a secure cloud drive. Demographic data to be collected includes:
   a. Gender
   b. Graduation year
   c. Major(s)/Minor(s)
   d. On-campus/Off-campus residence(s)

Laying out the backpack contents allows the photo itself to be more identifiable. Each individual item should be able to be distinguished from another, allowing a more comprehensive understanding of the individual’s Everyday Carry. The weight of the backpack was measured using hanging spring scales.
Earphones for focusing
Wallet
Gloves but not used all the time
Minions bottle
not a pencil case, actually a makeup bag
Planner for staying organized
umbrella, but not raining so just in case
notebook for class notes
Unstructured Interviews

An unstructured interview is a method developed to illicit individuals social realities (Zhang, Y, 2009). It can be defined as interviews in which neither the question nor the answer categories are predetermined. The unstructured interview was used as a method to understand more about the items carried in the bag that was revealed during the EDC data collection. The participant was asked questions that pertained to the general items in his or her bag. The interviews took place primarily at the location the EDC photo was taken, immediately after the EDC data collection was completed. This data was gathered to help provide insight into students’ ability to self express through their carried items.
Focus Groups

The use of focus groups was chosen to stimulate discussion among participants in order to obtain in-depth information on student lifestyles. Specifically, the team sought to understand how a student’s lifestyle is affected by what they carry. We sought personable anecdotes on what students struggle the most with in regards to carrying, why they carry what they carry, and what they wish they could carry, all while guiding the group discussion toward the relationship between carry solutions and self expression.

Three focus groups in the span of two weeks took place, each with about seven participants of diverse demographics and backgrounds was chosen by convenience. All participants gave consent that their demographics could be anonymously recorded. The focus groups was carried out in reserved rooms on campus, with incentives offered to the participants as a display of gratitude for allocating their time to the study. The incentives were 5 dollar Dunkin’ Donuts gift cards and each session took place for about 40 minutes. One team member was leading the discussion while other team members were chronicling the questions and responses, taking extensive notes, and anonymous quotes.

A brief initial exposition was presented to the participants explaining the purpose of the focus group and how it relates to the project. The participants was notified that for purposes of the focus group and how it relates to the project, it may be necessary at times for the facilitator to guide participants towards another question or to move on to allow another participant to speak. Once that was completed the moderator opened questions to the group allowing discussion to formulate. Some sample questions were:

1. What are your vocations/daily routine?
2. How much of what you carry is related to what you do?
3. How do you feel about your daily carry?

A full list of questions used for the focus groups is available within section A of the appendix.
Data Analysis

Data analysis was used in order to define trends and relationships between both quantitative and qualitative data. Relationships were reported through the use of graphs and charts, while the data was recorded in tables. Through this method we were able to report findings that we gathered through the EDC as well as observations from focus groups as a quantitative data set to complement the qualitative data we collected.

The analysis pertains to the data collected via EDC and focus groups. The items then, are compared based on their quantities, types and purposes. Additionally, they are cross referenced with focus group insights. Through this method we hope to attain a better understanding of how carried items relate to activities students pursue on a daily basis. In the same vein, we hope to express insights into activities that students want to, but may not be able to pursue during the day. We also hope to discover relevant trends between items and subject demographics. Furthermore, we hope to attain insights to commonality of muscle strain or back damage.

The results of this analysis were recorded and displayed in the form of charts, tables and graphs coupled with supporting descriptions, photos and quotations. Each photo was analyzed so that each type of item is recorded and its purpose, category as well as quantity. For purposes of this study the category of item, unless otherwise stated, were distinguished between Academic, Gym, Co-curricular, Personal, Hygiene and Medical. Academic items were items required by the students for their classes. Gym items were items required for the student’s exercise and physical activity. Co-curricular items were the items needed by the student for activities that do not pertain to academic study. Personal items were items which hold value to the individual or are used as pieces of self expression. Hygiene items were items which enable an individual to be more clean but do not provide any greater health benefits. Health items are items that provide a direct health benefit or impact.

Items also received a purpose categorization. Items were categorized between Mandatory, Future, Memorabilia, Auxiliary, Excess/-Forgotten and Recreation. Mandatory items defined items that are mandatory for an individual to go through their day. Future items defined items that are carried in security for potential future events, or insurance against unprecedented events. Memorabilia were items that have memories or an individual’s past tied to them. Auxiliary items were items that are not necessary for the individual to go through their day. Excess/Forgotten items were items which were found to be left in the bag or items that the individual had forgotten where in the bag and where found during the EDC. Recreation defined items that enable the individual to engage in their specific recreational activities.
“After all, there is a value that individual holds for these brands or possessions found inside the handbag, for the purpose of utility, enjoyment, representations of interpersonal ties, or identity/self-expression”

- Dr. Han Han
Tools are used to aid in the completion of tasks by an individual. Data shows correlations between an individual’s carry and the particular item carried, as the item associated with completing a certain task. Kelly Tian from the University of Kentucky postulates that carried items enable an individual to achieve more. The individual can complete tasks they may not be able to complete without their carried item. This is seen throughout our EDC as well as focus groups. Within the EDC, we noticed that there were multiple individuals that carried items with them which are related to a specific task. These were often tasks that did not directly relate to the student’s academic career.

By carrying a water bottle with them, students are enabled to drink water and maintain a healthy habit. 52% had water containers.

Headphones and earphones enable individuals to listen to music, make private calls and work in a focused environment. 73% carried earphones or headphones.

Medical items enable an individual to combat sicknesses and health emergencies. 28% carried medical items.
Self can be defined as the expression of one’s own personality or the assertion of an individual’s traits. Many items found within the backpacks of students who participated in the EDC study were enabling items that allowed them to become more than just students, and express their own personality or individual traits. Students from the focus groups also expressed that they carried enabling items:

“My music folders and stuff are always on me, since I’m in the Men’s choir”

Another student states:

“I Dumpster Dive, my backpack is filled with odd items I find in the trash”

One of the participants who was a varsity swimmer stated that she carried:

“2 swimsuits, 2 goggles 2 everything because we practice twice”

These an other similar items found in student backpacks act as vehicles and tools from which they are able to self express.
Compartments were found in many participants carries that were separate bags or containers to the participants backpack. There seemed to be a strong need for compartmentalization as many items taken out of the bag were stored in their own compartments. For example, laptops often had their own zipper compartment whereas smaller items had their own much smaller compartment. However a majority of the items in the backpacks were merely stuffed into compartments that they could fit in. Organization was not always consistent, but each individual had their own way of organizing their items such that they would know exactly where to find items in their backpack. There was also less specific compartmentalization in the backpacks, often certain compartments were repurposed to hold multiple different items or other items the compartment may not have been designed for just because it fit.

“More compartments would be nice so I’m not always fishing around for stuff”
“I don’t need any books”
Only 16.7% of participants carried textbooks
8.3% STEM - 8.3% Non STEM
80% of participants carried laptops or tablets

“I have a lot of crap in my backpack. Just stuff I never take out”
30% of participants had been carrying trash for over a week
22% of participants had visible crumpled papers and trash in their bags

“Paper is just better”
70% of participants carried notebooks
Nearly 2 per person
Number of items Carried by Male vs Female Participants

Fig 5. These graphs display the number of items owned by Male and Female participants out of the total number of the respective items.

Avg Backpack Weight vs Grade

Fig 3. The weight of the backpack seemed to be the heaviest for the freshmen, while the weight significantly drops for sophomores while then increasing steadily for the following three classes.

Carryall weight for female participants on average, was four lbs higher than males. Figure 5 shows some notable differences between the number of certain items carried in male and female carryalls. All three of four items were categorized as auxiliary, and future items. This shows a difference in the packing mindset of females and males within our participants. According to the data females seem to have a tendency to pack for future events, such as thirst or hunger, or for insurance against unprecedented events. This packing mindset could be one of the biggest reasons for women to have on average a heavier carryall. Our outliers for both number of items in carryall and weight of carryall were all women, which supports the hypothesis. It is likely that the future oriented packing mindset is correlated to the weight and number of items carried by females.

Fig 4. Weight of carryalls for Females was almost 4 pounds greater than that of males.
Hand tools found in some students backpacks may act as a vehicle which enables them to achieve and accomplish more in regards to projects they may have. Often times these projects relate to the student’s major. According to Fig 6 Robotics Majors are most likely to have hand tools. This directly ties into the nature of their hands-on, project based curriculum, and the tools act to enable them to complete labs. Many of the hand tools found were screw drivers and tool boxes relating to specific classes. In the same vein electronics and other digital technology enable students to be more productive. However these devices need to be charged, and certain majors may require more electronics in order to maintain productivity. Fig 7 indicates that Robotics and Mechanical majors are most likely to carry charging chords, indicating that these students are most likely to use their electronics for extended periods of time.
Redundant items, or items that appeared more than once in an EDC, were also present and offer some valuable insight. Many students were found to be carrying more than pair of headphones, multiple calculators, multiple extra articles of clothing, etc. After inquiring about these redundancies during EDC interviews and focus groups, the main reasoning why students carried multiples of an item were for self-expression. Students that said they carried multiple headphones stated one pair was for listening to music to “focus on studying” and the other pair were for “style/walking around” while listening to music. Students also explained that they brought extra clothes with them in order to perform certain activities such as going to the gym, attending meetings, etc.

“\textit{I’m afraid that I will need things later so I usually try to pack so I have anything I need when I need it}”

However, redundancy also served a more important function of insurance for future events. In such a way many students carried multiple of a particular items in the event that they may either lose the item or need them in an emergency. These items were often not replaced and so multiple would exist such that if one were to be used they would not need to be immediately replenished. There were many items that were found in the backpacks that did not pertain to specific tasks that were known to be performed on the day. While the backpack carried primarily items that enabled an individual to complete the planned or scheduled tasks, there were many other items that enabled the individual to complete tasks that were uncertain to happen during the day. This level of preparation was seen throughout a majority of participants.
Focus Groups yielded common themes and trends amongst all three participating groups. One of the major similarities was a sense of hardship that each student expressed throughout the discussion. No matter which question was asked, there were at least 3-4 participants that described their struggles with carrying and maintaining what they carry. There were also a number of comments that pertained to how heavy and painful some backpacks were.

“I have issues with my back and have visited a chiropractor for it multiple times, and the heavy backpack sometimes exacerbates the situation”

“When I take off my backpack I can feel my back in physical pain”

“I carry the right amount, just what I need, it’s still pretty darn heavy”

“I got a heavy laptop and a notebook, and an art kit, it’s too heavy so I try not to bring it most days”

Many of the comments given pertained specifically towards the usage of the backpack to carry items that the student deemed to be necessary throughout the day. Particularly struggles were highlighted in terms of being able to pack the necessities for the individuals day to go as planned. As well as quotes pertaining to carry in excess

“I try to take what I need for the day but really it varies from day to day what I bring and how I pack”

“My gym bag can sometimes be too big to carry”

“Sometimes I have to stay gone from my room for 12 hours, but I still need to back and forth to change stuff”
Participants also commented towards self expression and individual carry in terms of them being able to be more than just students. As well as items that enable them to live a healthy lifestyle.

“oh, I usually have a separate bag for lunch, this is because it does not carry in the bag”

“I wish I could go to the gym more but I can’t carry my gym stuff with me”

“I find that there tends to be a difference between what you need and what you prefer to have”

“I like to bring my papers and scripts with me since i do a lot of theatre with the masque group.”

“At one point I had a back scratcher, it was pretty useful”
This study explores three key concepts related to student carrying culture. First, we investigated the type and number of items that WPI students carry. Second, we studied how each of these items enable the individual to perform and complete certain tasks. Third, we explored how the items that students carry enhance or limit their lifestyle choices. Through this research, we hope to bring to the attention of students, school administration, backpack designers, doctors and physical therapists relevant design and health issue that we feel are usually overlooked. We also hope our work will be used in future studies that aim to improve the lifestyle and self-expression of WPI students.
What an individual carries empowers what they can do, and what they do characterizes who they are. Within the context of students carrying their belongings in a backpack, it can be said that their ‘Self’ is expressed by their possessions and the items they use day-by-day to accomplish goals. When they do not have these items or are unable to carry them, they are incapable of completing tasks and as a result, according to Sartre in “Being and Nothingness,” their ‘Self’ abates. What they are able to achieve is curtailed, and their potential to either carry out work or express themselves also diminishes.

In short, Sartre postulates that the only reason we have things is in order to enlarge our sense of Self. Throughout the EDC, interviews and focus groups, a number of students made comments or displayed certain items that they were carrying which related to Sartre’s postulation. In addition to studying for a degree, students have many other roles and facets to their ‘Self.’ Without certain items, a student may struggle to express that unique component of their ‘Self.’ For a student, Self is, in part, expressed by the individual’s possessions. Evidence of this relationship can be seen primarily through the diminishment of the sense of self when possessions are lost or stolen. In the case of a student, a similar diminishment of self may be seen. For example, an item not carried in their daily backpack could lead to a student’s inability to accomplish certain tasks, thus leading to a diminishment of Self. This is expressively shown in the focus groups, as some individuals stated that they would visit the gym more often had they brought their gym clothes and equipment with them. Another student’s sheet music and scripts allows them to rehearse and perform. Additionally, from a student’s music folders to what they bring to the gym, most students had a unique item or set of items that differentiated them from others. The items they carry enlarge the student’s sense of self, and allow them to become more than just students.
Clutter may also occur in the everyday items that a person carries with them, which may lead to disorganization and low productivity. In the case of a WPI student, this clutter often occurs within the backpack (which is, arguably, a student’s “desk”) and thus may affect a student’s ability to self express and their workplace productivity (Tian, 2005). In a student’s case, the workplace would be the classroom, university, or educational environment. The EDCs specifically showed various occurrences of different kinds of clutter. Some participants accrued clutter through the mismanagement of trash and litter within their bags. Others accumulated clutter from overstocking of certain items, while for others, clutter simply arose from lack of organization in a certain area within their backpacks. Focus group interviews reinforced this idea as many students complained that their carryalls did not have the capacity to keep items organized and clutter free.

If objects found inside one’s bag are a “conscious exercises of freedom,” the organization of the possessions can be said to reflect a conscious exercise of “manipulation” over the experience of a person’s self-identity construction (Han Han, et al). Apart from a practical utilitarian purpose, study participants tended to organize their “clutters” into several small bags. Participants collected items that expressed a similar purpose or value, and compartmentalized them in smaller plastic bags within their carryall. In a sense, participants were issuing a conscious exercise of freedom of their personal identity. Different items had different utilitarian and economic value to different individuals; hence the self-structured compartmentalization of items that participants exhibited is also a strong expression of Self in the meaning that they ascribe to the items.
Our study includes 60 total participants out of 4214 undergraduate WPI students, which is just 1.4% of the student population as of spring 2018 (Division of Enrollment). We recognize that our sample size is small relative to the total size of WPI undergraduate population. Furthermore, participants were selected based on convenience sampling. As a non-probability sampling method, convenience sampling is limited and thus, we acknowledge that the quantitative data might have some inaccuracies. However, our data provided us with deep insight into students’ lives and the effects that the items they carry have on their lives.

In this study, the data was acquired from September of 2017 through the end of January 2018, which means the carried items could be affected by the season. This is another potential source of inaccuracy in our data. Other limitations include the lack of depth to the unstructured interviews. Having a more structured interview that inquired about every single item within participants’ backpacks may elicit more comprehensive data and allow analysis based off of a profile of the individual participant. This might grant stronger insights into the purposes of items carried and their differences between individuals.

In our study, we did not consider as heavily self expression through the use of stickers and colors and other aesthetic factors. While many different carryalls contained various items covered in stickers, and some were themed under certain color palettes. This is an aspect of self expression that we did not delve into, but is definitely an avenue worth pursuing in the future to further understand the depth of self expression.
Throughout this study, students provided us with substantial insight into many facets of student carryalls. The process behind how they pack their daily carryall, what they need to be successful (uniquely defined by the individual), and their ability to use their backpacks and carryalls as a vehicle of self expression are just some of the insights that we gained. In addition, students expressed many shortcomings of carryalls. Specifically, the shortcomings varied and yet were still significant to the experience of the individual. Some students spoke about the ineffective design to their carryall. Others related to physical pain, lack of organization, and lack of campus storage alternatives as hurdles to their ability to self express through their carryalls. Based on these shortcomings, different recommendations can be proposed to unique groups or “stakeholders” that are affected or effect a student’s carrying experience.

From the shortcomings, some distinctive groups are: the students themselves, backpack designers, school administration, and doctors or physical therapists.
Throughout this study, students provided us with substantial insight into many facets of student carryalls. The process behind how they pack their daily carryall, what they need to be successful (uniquely defined by the individual), and their ability to use their backpacks and carryalls as a vehicle of self expression are just some of the insights that we gained. In addition, students expressed many shortcomings of carryalls. Specifically, the shortcomings varied and yet were still significant to the experience of the individual. Some students spoke about the ineffective design to their carryall. Others related to physical pain, lack of organization, and lack of campus storage alternatives as hurdles to their ability to self express through their carryalls. Based on these shortcomings, different recommendations can be proposed to unique groups or “stakeholders” that are affected or effect a student’s carrying experience.

From the shortcomings, some distinctive groups are: the students themselves, backpack designers, school administration, and doctors or physical therapists.

Many comments from student surveys addressed a common problem of disorganization as well as suboptimal use of space within their carryall. A recommendation, albeit a self evident one, is for students to organize their carryall more often. Removing old materials and trash, ensuring all items being carried have a proper compartment or space, are just a few examples of how to optimize a student’s carrying space. While this is self evident, we observed that many students did not follow this practice and it may be worth being reminded periodically to do so. During focus groups, many students also advised that having folders or agendas helped them to remain organized and inline with what they wanted to do. While an argument can be made that clutter and trash in a backpack is representative of that person’s ‘Self,’ it is a negative aspect that many students said they strive to minimize in order to make full use of their carryalls, and as a result might have the ability to express more facets of their ‘Self.’ By removing trash and clutter, an individual will be able to be more organized, increasing the space available to carry other enabling items while providing a clearer and stress reduced mindset to the students.
Also, from the data that was gathered, it was determined that the average WPI student carrying weight was within the recommended national carrying weight. Although the average weight was within recommendation, the data also demonstrated that there were some outliers at both extremes carrying either very little or much more than the average. To the students carrying more than the average, weight has a significant impact on one’s body. Due to the design of most backpacks, the carrying weight is distributed such that it is off-axis to one’s body. As a result, the carrier must offset their body in order to compensate for the off-axis weight, causing them to slouch or lean forward while carrying a backpack. This compensation may lead to spinal and back-related issues in the future, severely affecting the health and quality of life for individuals who offset their backpack weight this way. A recommendation that can be made for this issue is to implement axial-loading carrying methods. Bags such as totes or messenger bags load weight onto a person's side, which is within the axis of that person’s body. By implementing this method, it would allow students to continue carrying what they need, without the strain and discomfort that comes from using a traditional backpack.
For school administration, one recommendation to further assess is the possibility of implementing a locker system on campus. This was a widely discussed topic throughout the focus groups. Many students conveyed the usefulness of being able to “deload” their belongings throughout the day to lighten the load of their backpack. By doing this, they feel less strain on their backs and as a result may have fewer pain related issues. The locker itself might serve as a secondary vehicle for self expression for the individual, allowing students to have access to more facets of their ‘Self.’ Being able to perform tasks and duties that they wish to do grants students an opportunity to pursue actions and activities that help them achieve their potential.

Another recommendation to school administration is to increase accessibility and advertise the equipment and services that are already offered to students for free. Items such as: food containers, headphones, lab goggles, utensils, phone chargers and other digital equipment are available on campus. We found that many items that individuals carry with them every day can be, in fact, offered for free or easily borrowed on campus. Items such as lab goggles, headphones, staplers, and phone chargers can all be attained for free. If students have easy access to these items then they would not need to bring them within their carryalls. In doing so, student’s backpacks would have more space to carry additional items relevant towards their own self expression, empowering them to pursue a better version of Self.
Throughout the EDC and focus groups, we observed that while there were similarities between each student's essential carry items, there were also significant differences in the auxiliary items found inside participants' bags. This was largely in part due to the differing lifestyles and personalities of each person, necessitating a unique expression of self. In response, our team recommends backpack designs in the future that incorporate concepts of modularity. Modularity, or the ability to add and withhold certain components, would allow a backpack or carryall to become a true vehicle of self expression. By utilizing detachable and reattachable modules, each with their own specific task, an individual would be able to customize their carryall towards their own self expressive needs. For example, if an individual wanted to carry gym clothing or shoes, instead of carrying an entirely separate bag, the items would reside in an aptly-sized compartment that could attach to the main backpack which housed the daily necessities as determined by the individual. The same concept can be applied to items such as food containers, water containers, headphones, loose papers, etc. This concept works in conjunction with the “better compartmentalization” concern that students expressed. This would not only empower individuals to be able to better self express through their backpack but also reduce the physical strain and negative effects of carrying multiple bags by condensing them into one singular, organized carryall. Designers should also consult healthcare specialists in order to confirm their designs are compatible with the proper guidelines and the weight loading profile suggested for each user group.
For health care providers of college students, based off of the research from the literature review and background, the main recommendation that can be given is to inform patients about proper carrying guidelines. This information would include not carrying more than 10%-20% of their total weight (Parker-Pope, 2009). Another is to utilize axial loading techniques (using laptop bags/side bags) to ensure that their carrying weight is not off their main body axis.

After the we had completed the data gathering of the study, we agreed upon this sentiment:

We are not just machines carrying utilitarian features, we are human, with the innate desire to continuously improve upon our own selves. The purpose of a backpack is not just to be tool for work and utility, but so that we can become more fulfilled human beings through self expression.
Curiosity

Our team’s collective sense of frustration and hardship with our own carryalls was the driving force for starting this study. We realized that all team members found themselves lacking items that would enable them to do what they desired on a regular basis, and we all felt a need to address this issue. During our study, we came in contact with many individuals that felt the same void as we did as a group. This fueled us even more to, initially, try to come up with a solution to help a large section of our community. We discovered, though, that the scope of this issue was much larger than we anticipated, and this discovery made us take a step back and look at the big picture. This enabled us to explore that what we carry not only enables us to be involved in more of our desired activities, but what we carry also enables us to be the person we want to be.
Connections

From what we gathered from EDCs, focus groups and unstructured interviews, we made different associations between students and other key groups. These groups ranged from the school administration to designers and manufacturers of backpacks. One connection that formed between students and school administration was a dissatisfaction in regards to helping students with their carryall. Another connection we found is between students and backpack designers, a dissatisfaction in the case of poor carryall design. Many more connections were made between students and other groups, such as the one formed between students and health care providers. This connection contains the sentiment that health care providers could provide recommendations to college students about proper carrying methods to decrease the negative impacts on their bodies.
Not much has really changed between my past and current EDC. In general, I am carrying about the same. I no longer need a clicker or molecular modeling kit since I am no longer taking classes that require me to have them. Most of the clutter has been cleaned out to make my bag more organized. I have started bringing my laptop charger with me, since I am finding myself working on campus for longer periods of time. The same reasoning applies to the snacks and the computer mouse. Another interesting point is that I no longer work for Dominos, so the welcome card has been thrown away. I still considered it clutter in my bag even when I did work there, but now it is no longer a part of my identity. This study has made me a little more self aware.
Jonathan

My initial EDC and my current EDC i think are vastly different. For one thing I think The biggest shifts in carry are the different laptop, and the significantly greater amount of sentimental items. However, through the focus groups and the EDC studies we did, I realized just how much garbage I had been carrying around in my bag, throughout the course of the study I took some time to go through my bag and throw out or remove the things I didn’t need. Oddly enough, the increase in sentimental items such as photos and smaller keychain items came from having receiving them and not removing from my bag. The change in laptop and addition of the calculator is an indication of my shifting priorities from when the first EDC was taken versus the second. However the plastic knives are still there. I still haven’t found a reason to use or even have them, but I never took them out. The only item of sentimental value that has a real use is the new notebook, which initially was supposed to be a sketchbook, that I received from my sister. I still however am not carrying with me any gym equipment and find that I am, regardless of wanting to do otherwise, am not exercising at all.
In terms of weight my carry was substantially above average with a few “rare” items such as lab goggles and deodorant. Even though I still carry those items, I have cut down on my total weight and total number of items. This is mainly due to the shift from use of analog to a more extensive use of my digital items. Instead of carrying a note notepad I use an app on my phone to keep my to-do list and buy online versions of my books. I type up most my homework assignments instead of handwriting. While doing the EDC on computer science and electrical engineering students, I realized that some of their carryalls weigh less than half of mine. Through the interviews and the focus groups I realized one of the main reasons for this weight discrepancy is the excess amount of paper I have in comparison to them. The shift from analog to digital is not a new concept anymore and with some professors already starting to make that shift, it should only get easier for the students to convert as well.
Appendix

A. Focus Group Questions

What are your avocations/daily routine?
How much of what you carry is related to what you do?
How do you feel about your daily carry?
How do you feel about the size/weight of your backpack?
How do you pack Walk me through the process of packing your bag (Timeline/when)
When do you prepare your backpack and how do you prepare your backpack
What are your thoughts on how much you carry everyday? Too much, too little, etc.
What types of things do you carry in your pack?
How much of what you carry is related to what you do?
What about your backpack makes it personal, Are there items that's personal and meaningful to you.
What do you need to be productive during the day?
Does anyone have any more recommendations?
People said more compartments, you agree/disagree
B. Excel Sheet Organization

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C. Demographics

Number of participants by gender:
Male: 29
Female: 30
N/A: 1

Number of participants by major:
Chemical Engineering: 11
Mechanical Engineering: 10
Robotics Engineering: 9
Mathamatics: 3
Biotechnology: 5
Biomedical Engineering: 3
Electrical Computer Engineering: 6
Industrial Engineering: 1
Interactive Media and Game Design: 2
Management Engineering: 1
Civil Engineering: 1

Individuals with multiple majors: 8

Number of participants living On or Off Campus:
On: 27
Off: 33

Number of participants by graduating year:
2018: 7
2019: 30
2020: 13
2021: 9
References


“What are your EDC essentials?” Everyday Carry, everydaycarry.com/


