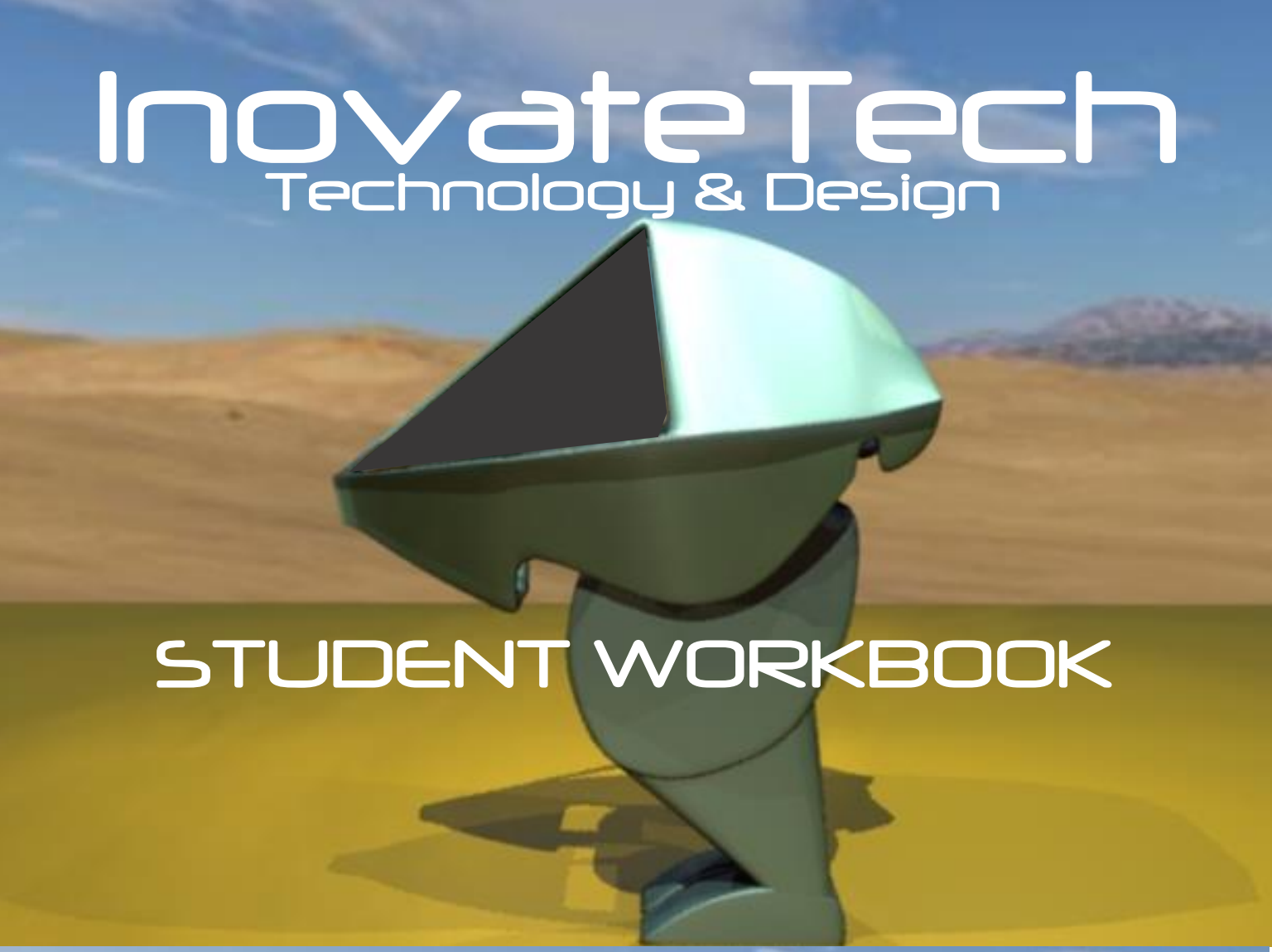
InovateTech

Technology & Design



STUDENT WORKBOOK

J.L. Allyn

InovateTech

Technology & Design

Student Workbook

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http://textbooks.inovatetech.org

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INNOVATIVE TECHNOLOGY DEVELOPMENT PROCESS

1. Look Into the Future

A. DEVELOPMENT TAKES TIME

While you prepare to get started on your first project, the most important thing for you to know is that development of any kind takes time. Whether it is learning to make a sandwich, ride a skateboard, build a bike from a frame, develop your own makeup technique, or prepare for your first job. It's all about time.

So, you will utilize patience and perseverance to get to the result you want to achieve.

And you also need to manage your time and not try to do everything at once. Managing your time is important. For example, you can devote a set number of hours per day on your project, possibly spread out between school and home.

But be careful not to overdo it or you might overwhelm yourself and get stressed out. So, you want to pace yourself with a reasonable number of hours each day toward the result you want.

Result, results, results. That's what it's all about. Putting in the development time to achieve your desired result.

B. IMAGINE INTO THE FUTURE WITH "I HAVE" IMAGINING

How you think is as important, if not more important, than what you think. And when you are innovating, you are only limited by yourself. Therefore, see yourself using the concept you are developing in an "I have, I am" way and in an unlimited manner. When you think in an "*I have, I am*" manner, you are better able to see yourself and others using and benefiting from your innovation, free from limitations.

Therefore, when you write out your project goals, the goals only you will look at, write them down as, "I have developed a new way for cars to propel." When you do this, your brain does not want you to be embarrassed, so it automatically helps you generate the ideas necessary for you to bring your innovation to the desired results you want.

It is almost like your brain cells say, "*Does she/he really believe this? Well, we'd better help this happen, so she/he won't be crazy*."

Remember, you are only limited by what you can envision. So, reach out into the future. See the current state of the product or service you are improving and then imagine how it might change in 20 years. Then imagine how that will change another 20 years later. And then another 20 years later. Then, sit back and ask yourself, "*How can I make it now… today?*"

In this way, the Star Trek TV series telecommunicator was our cell phones and now our smartphones of today. Somebody imagined that concept for the TV show and other people figured out how to make them a reality today. And now we cannot seem to live without our smartphones!

Therefore, imagine! If you can imagine it, you can do it. So, start imagining! And start innovating! Think to yourself, "*I have a great idea*," and then start writing out the description and drawing out what it is!

C. WHAT WILL EXIST IN 100 YEARS THAT I CAN DEVELOP TODAY

In the previous page, we discussed thinking out into the future about improvements of current products and services 20, 40 and 60 years out into the future. When you do this, think about how the improvements will help satisfy needs of human life 100 years ahead into the future.

Look at the NASA design above. How will the wide body of the conceptual aircraft benefit the passenger crew, the pilots, the company and the aircraft itself? Use your imagination and write down three ways it will benefit each category. The first answer is filled in to help you think outside the box, which means outside of what's obvious.

A. How will it benefit the passengers?

1. *There can be an onboard soccer field for those boring, long flights and an onboard beauty salon*
2.
3.

B. How will it benefit the passenger crew?

1. *Fuel tanks no longer must be in the wings, so the crew can have an in-flight lounge in a wing*
2.
3.

C. How will it benefit the pilots?

1. *The rear upper wing can have an elevator to take pilots up to an optional navigation flybridge, from where they can fly the aircraft from an alternate view, with the ability to see both forward and rearward*
2.
3.

D. How will it benefit the company?

1. *With so much surface space, the company can be a flying advertisement board and ear additional revenue, like the way a blimp flashes lit messages and advertisements to people below*
2.

3.

E. How will it benefit the aircraft itself?

1. *The aircraft, having artificial intelligence with emotions, will feel better about itself and its amazing design*
2.
3.

D. EXAMPLES OF DEVELOPMENT:

Ancient

Did you know that it was females who developed commercial markets in ancient Egypt? It's true. And to supply the markets, other females developed large-scale farms to supply the females selling in the large commercial markets.

Then, to manage it all, females developed writing so that reports could be written and provided to them from related to sales in the markets and about the agricultural production. The first female to develop writing in ancient Egypt was called *Swaswu* (aka Sheshat), from a word that means "grammar." She is also credited with teaching reading and writing, along with mathematics and architecture.

And if you think these were older women doing all this, think again. Girls became adults at 13 back then and thus began innovating at an early age. This is also why *King Tut* today is called a "boy king," because just as girls became adults at 13, boys became adults at the same 13 years old, too.

Therefore, you are never too young to be an innovator!

Modern

You do not have to have a huge laboratory or factory to innovate! Many of the high-tech products you use every day were conceived in garages. This includes the Apple computer.

A garage at 2066 Crist Drive in Los Altos, California, is said to be the birthplace of Apple computers and from where Steve Jobs and Steve Wozniak launched Apple Computers.

Future

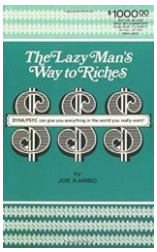
In the future, it is likely that humans will no longer be the primary developers of products and services. That job will likely fall to artificial intelligence.

Artificial intelligence will not only likely decide what will be produced for humans. It will also likely be responsible for determining what humans need and deserve to have.

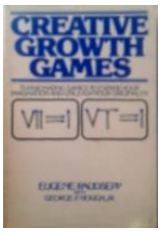
How would you like a robot determining what you can buy in a store or services available to you, determined not by consumer surveys and test marketing, but instead by some complex computer algorithm?

** An algorithm is a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer*

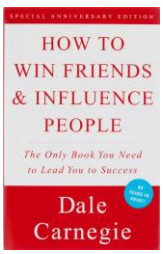
BOOKS/GUIDES:



The Lazy Man's Way to Riches by Joe Karbo, a guide to goal setting for exact and powerful results.



Creative Growth Games by Eugene Raudsepp and George P. Hough Jr., introducing a hands-on guide to setting one's minds free of limitations. Seventy-five stimulating numerical, verbal, and spatial games are designed to test and promote one's problem-solving abilities and creative imagination.



How to Win Friends and Influence People by Dale Carnegie, a guide to understanding people on the deepest levels. This time-tested advice has carried countless people up the ladder of success in their business and personal lives. One of the most groundbreaking and timeless bestsellers of all time.

MENTORS:

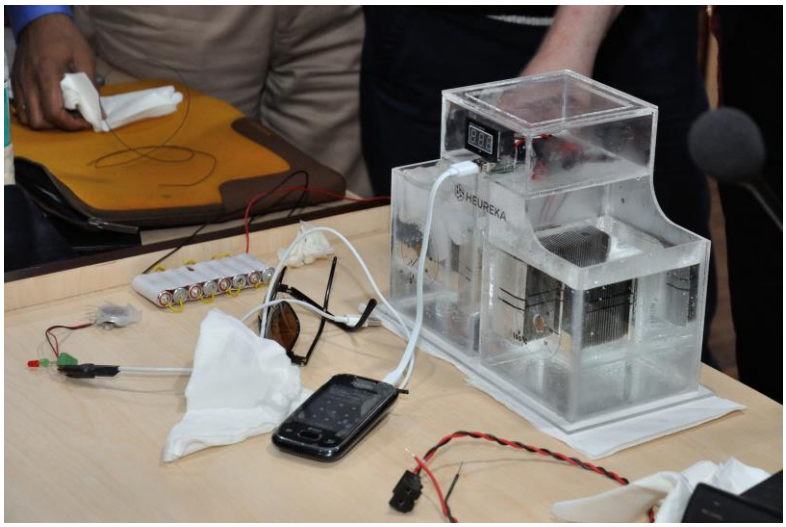
NASA

Automakers

Various product manufacturers

Quirky Social Product Development

2. Design and Build a Prototype



The greatest part about building your initial prototype is you can utilize anything you have laying around. You likely have laying around in your home lots of items that have been left unused. You also likely have scraps of metal and wood from home or auto repairs. All these materials can be cut up, bent and molded into shape to form the first iteration of your prototype.

It is important to benefit from what's available to build your initial prototype, as well as what does not seem to appear to be quite right. And you are not striving for perfection with this first version. It is the first effort that is most important, because by doing a first version, you will be inspired to make corrections and improvements. Often what does not seem quite right can be turned into a benefit, so they should not be afraid of making mistakes.

The point is, product development and prototyping is full of discovery. And that is what makes it so exciting and rewarding.

There was once a TV commercial about Reese's Peanut Butter cups, where two boys collide at a building corner, the first eating a chocolate bar and the other eating from a jar of peanut butter. One says to the other, "Your got chocolate in my peanut butter," and the other says, "You got peanut butter on my chocolate!"

The result, the narrator announces, was a great new peanut butter and chocolate snack… *Reese's Peanut Butter Cups!*

So do not waste what may appear to be mistakes. You might come up with something brand new and exciting in the process of building your prototype.

A. WHAT RESOURCES DO YOU HAVE AVAILABLE?

As we discussed on the previous page, you have a wide range of items already at your disposal, which you can utilize in building the first version of your prototype. Not only raw materials including sand, wood, metal and plastic. But there may be electronic products just laying around that you may be able to make good use of in your prototype.

But material resources are not the only resources you have available to you. What about human resources? You mother and father may know something about the field or industry for which you are building your prototype. It could be a relative or even a neighbor. Therefore, you also want to take inventory of your human resources.

Below, make a list of the different types of resources your prototype can benefit from. List up to 10 sources for each category. The first of each category is filled out to help you think outside the box.

A. Material Resources (including but not limited to components, tools and workspace)

1. *Box of toothpicks, which I can use to glue together the basic shape of my prototype*
2.
3.
4.
5.
6.
7.
8.
9.
10.

A. Human Resources (including but not limited to family, friends and paid consultants and freelancers)

1. *My aunt Betty, an assembler for Boeing, who can teach and help me solder electronics*
2.
3.

4.
5.
6.
7.
8.
9.
10.

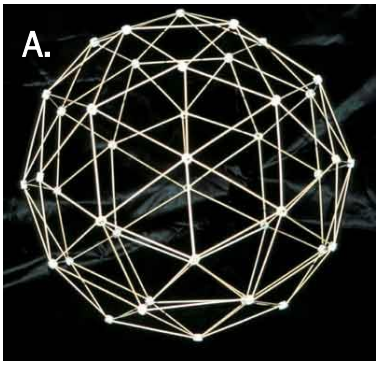
B. HOW CAN YOU COMBINE RESOURCES TO BUILD A PROTOTYPE?

Be resourceful! You can combine resources to build your prototype. We will be a little outrageous to make a point. You see the soap water bubble the girl is forming in the photo above? Now let's go back to the *toothpicks* resource example on the previous page to understand how you can combine resources for the initial version of your prototype.

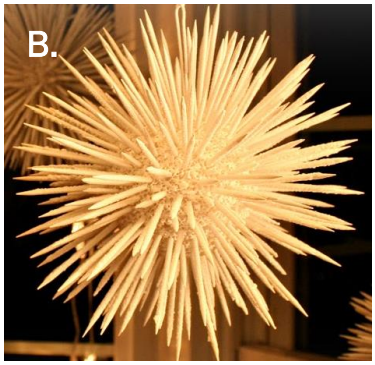
Imagine you are deciding how large to form the bubbles and want to make a prototype of the bubble itself, one that won't pop. So, you can use the toothpicks and glue together enough of them to form the shape and size of the bubble you are envisioning your bubble machine can make.

Next, after you build the shape with toothpicks glued together, you can go into the kitchen for Saran wrap or other plastic wrap for food. Simply wrap the toothpick bubble frame with the plastic wrap. Since your mom is one of your *human resources*, be sure to ask first before you use the toothpicks and plastic wrap.

While your first thought might be to shape the toothpicks into a geodesic sphere, as in example A below, thinking *outside the box*, you can build the toothpick frame with a Styrofoam ball in the middle and simply stick in toothpicks until a basic sphere is formed, as in example B below. Either way, both would be great for wrapping with plastic wrap for your bubble prototype!



... or...

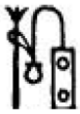


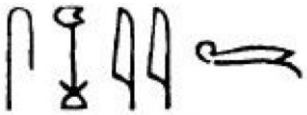
And while your mom holds your completed toothpick sphere, you can wrap it with plastic wrap. Two heads are often better than one! □□

C. PHOTOGRAPH & VIDEO THE DEVELOPMENT OF YOUR PROTOTYPE

As mentioned earlier, writing was invented by female merchants in ancient Egypt to manage market sales and large-scale agricultural production, beginning 5100 years ago. While the female merchants were focusing on other issues, reporting clerks would be out in the field, at farms and in factories recording what was occurring there. This even included the written recording of negotiations and sales. These reports were then provided to those in charge as part of the overall management tools they utilized.

The field clerks in the scene above are not only watching the workers, they are recording what the workers are doing. What are they writing with? They are writing with a long thorn, as is recorded in the Rosetta Stone.

 = the general hieroglyph for the word “scribe”

 = ishokh (i-SHOKH), “thorn” in the Rosetta Stone

In fact, the ancient Egyptian hieroglyphic word, matet, is the ancient Egyptian verb for “report.” Reports help you keep track of not only where you have been, but also, they can help you decide where you are going, too.

 = matet (mah-tet), “report, make clear”

In prototyping, it is important that you take lots of photos as you build your prototype. Especially because, once it is successfully built, your photos can help provide the basic step-by-step blueprint for building another one. The same hold true for taking apart your prototype. By taking lots of photos during its deconstruction, you provide yourself with a way to easily understand its construction.




D. EXAMPLES:

Ancient

In ancient days there were no cameras, therefore descriptions were written out or illustrations were drawn to record events or actions in posterity. The scene below records craftsmen cutting, carving and forming products.

Image source: Kingn8link on Wikimedia

Modern

Today we have cameras that allow us not only to record a photographic, step-by-step way of documenting the construction of items such as prototypes. We also have video, which allows us to alternatively record the building of objects themselves. Even the recording of a service process. And with video, it allows us to see a time-lapse of constructing a product or providing of a service.

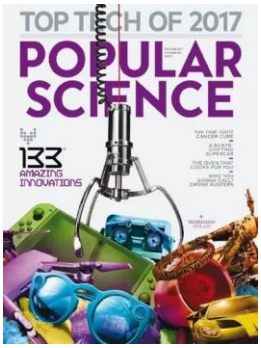
Future

In the future, it is possible that our bodies may be integrated with electronics that will allow us to share thoughts, and therefore memories, of our construction of a product and providing of a service. Plus, we may be able to wirelessly transfer these photographic and video memories to others.

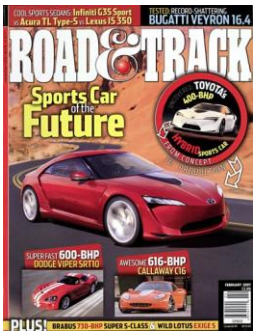
Alternately, with such technology, it is possible to envision eliminating the photographic elements of the memories, transferring to others wirelessly only the actions necessary to construct the product or provide the service. This would be much in the way a factory robot in an automobile plant receives digital instructions for assembling or welding a component in the form of a computer program.

Think it and it's done!

BOOKS/GUIDES:



Popular Science Magazine



Road & Track Magazine

Science Magazine

MENTORS:

Apple

Facebook

Google

TESLA

Tesla

amazon
seller central

Amazon

Hot Wheels

Mattel

McMASTER-CARR

McMaster-Carr Supply

Grainger industrial Supply

Apple

Facebook

Google

Tesla

Amazon

Mattel

McMaster-Carr Supply

Grainger industrial Supply

3. Test Your Prototype

Maybe you and your friends built a go-cart from lumber that was laying around and shopping cart wheels. Do you remember who was the test driver to go zooming down that steep hill on it? Or maybe you had a new idea for a new fashion. You got out your family's sewing machine, sewed the clothes together and gazed in amazement. But would your friends think it was as amazing as you thought?

Whenever new concepts you come up with, somebody always must test it. What if the wheels were to fall off on the go-cart when others ride it? Or the thread is too old, causing the clothes rip apart at the seams when someone sits down in public? So testing is key. It protects you and those who need what you develop.

In the development of products and services, for these reasons, product liability is an important factor. With adequate product testing, the risk associated with product liability can be dramatically reduced. But because of the nature of humans to use products and services outside of the recommended uses, the risk of product liability can never be completely eliminated.

What is product liability? It is the *legal liability that a manufacturer or trader incurs for producing or selling a faulty product*. According to the Wikipedia article on *Product Liability:*

> ***"Product liability is the area of law in which manufacturers, distributors, suppliers, retailers, and others who make products available to the public are held responsible for the injuries those products cause."***

While there is product liability insurance to protect you from any harm your product might cause a user, as you develop and build your prototype, be conscious that consumers may use your product in ways not intended or otherwise not recommended by you.

Therefore, as you envision and as you build your prototype, think in terms of effectiveness, but also think smart! Protect yourself and others from both potential defects and unwise designs that could otherwise inflict harm on the very consumers who may need your product. □

A. RUN A SERIES OF TESTS

Now comes a fun part of prototyping! To see how it works.

By now, you should have gone through several versions of your prototype, refining it at each step and photographing and taking videos of each version. Eventually you arrive at a version you can begin testing.

So, now it's time to test your prototype! What are the features that need to be tested? What are the reasons you are testing? How will you conduct the tests? Who will carry out the tests? And when will the tests occur? You will design your tests depending on the aspects of your product or service.

Below, list aspects of your tests.

Features to test?

1.
2.
3.

Reasons for testing each feature?

1A.
1B.
1C.

2A.
2B.
2C.

3A.

3B.
3C.

Who will carry out the testing?

1.
2.
3.

Under what conditions will the tests take place?

1.
2.
3.

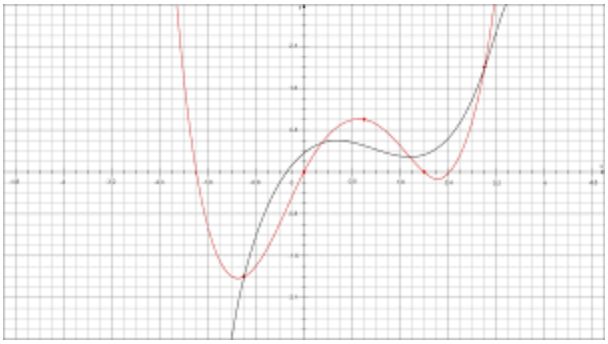
B. RECORD EACH TEST

Once again going back to the reason writing was developed, you will record the results of each test you conduct. This is an important step, because as you conduct more and more testing, and testing of different versions, you can compare features, components, performance and more.

You can utilize a spiral-bound journal for this purpose, to document general test results. But you can also design and print out a results chart, use a separate sheet for each test and conduct tests related to each version of your prototype. You can also design a template in a computer program such as Microsoft Word or Microsoft Excel, too.

And if you are analyzing a service, you can conduct and record your tests this way as well.

C. ANALYZE THE RESULTS OF EACH TEST



Now that you've conducted your basic tests, it's time to analyze the test results.

A. First, list aspects of your product or service of which you had acceptable or better test results, including why the results matter?

1. Why?
2. Why?
3. Why?

B. Next, list aspects of your tests that need improvement and how they need to be improved.

1. How?
2. How?
3. How?

C. List any unexpected results and what value they add to your product or service.

1. What?
2. What?
3. What?

With these basic test results, you can make improvements to your product or service and get ready to conduct consumer surveying. Consumer surveying will test the acceptance with the public.

BOOKS/GUIDES:

Consumer Reports

MENTORS:

National Highway Traffic Safety Administration (NHTSA)

Insurance Institute for Highway Safety (IIHS)

4. Implement Your Concept

A. IDENTIFY & SEEK OUT POTENTIAL USERS

Now comes the time to see how others evaluate the progress you have made with your prototype. So, now you want to determine who your potential user is.

A. For this reason, list describe 10 types of people (potential consumers) who can benefit from your product or service.

1. because
2. because
3. because
4. because
5. because
6. because
7. because
8. because
9. because
10. because

B. Now it's time for you to prioritize and narrow your focus, to maximize your time and marketing efforts. Therefore, list the top three from above based on need of your product or service, and list why the need is more important to those groups of consumers as opposed to the other groups.

1. because they need
2. because they need
3. because they need

Having identified your top three consumer groups, you have identified what in marketing relates to your top three *target markets*. These are markets you will target your advertising and promotion to.

B. COMPOSE A SELL SHEET TO GUAGE THE VALUE & NEED OF YOUR CONCEPT

Consumer surveying with a sell sheet helps you evaluate primary aspects of your product or service. These aspects are your goals in evaluating the receptivity of your product or service:

1. Cause the potential customer to understand what the product or service is and its benefits

Only once the potential customer understands accurately the product or service and its benefits you can move on to…

2. Have the potential customer state the expected price in the marketplace
3. Have the potential customer state what they would easily pay
4. Where they would expect to find your product available to purchase

Design a one-page product sheet, with a photo or illustration reflecting the product or service and a description of it and its benefits. Hand the product sheet to an individual and ask them to read it. Your survey can use a separate sheet of paper or a spreadsheet for you to record each respondent's answer to the following questions:

A. What is the product (or service)?
B. What does it do?
C. What are the benefits?

Only if they answer these questions accurately, you can continue…

D. How much would you expect it to cost?
E. How much would you easily pay?
F. Where would you expect it to be available for purchase

On the following page, design your promotional sell sheet as follows:

A. A headline at or near the top to capture the reader's attention
B. A photo or illustration of your product or service in the box
C. For the product or service:
    1. Describe the important and distinct functions and features
    2. Describe any innovative technology involved with it
    3. Describe the intended customer
    4. Describe the benefits that will be delivered to the customer
    5. Describe how the it will be made available to the customer
D. A logo at the bottom and contact info

Some examples of sell sheets…

After you survey 12 people, you will begin getting a good idea of the value of your product or service and how it will satisfy a need in the marketplace.

If by chance an individual you survey does not understand what the product is (their answers to A, B and C), it is your job to rewrite it in a way that it can be understood on the product sheet. Because there is no value of your product or service if the information you provide is misunderstood.

After editing your product sheet so respondents can understand accurately, you can move on to the pricing and availability questions (questions D, E and F).

And notice questions D and E, the expected price and what the respondent would easily pay. The expected price is normally higher that the price that a consumer would easily pay. In this way, while a Lamborghini might cost $350,000, a respondent might say they would expect it to cost $1 million, but would easily pay $30,000, especially since that's all the individual might be able to afford.

So, based on the answers to D and E, you might decide to start out selling the product or service at the easily pay price. But on the other hand, it is easier to reduce a price than to raise a price, therefore you might decide to start with a higher price and gradually reduce it to maximize sales.

Note: Before introducing your product to the market (including test marketing), you can apply for a provisional patent to help protect your product design or utility. More about this is available from the U.S. Patent Office by calling them toll-free at (800) 786-9199, where helpful operators are there to help answer your questions about the patent process.

C. TEST MARKET TO SET THE RETAIL PRICE

Now that you have some data on the usage, value and price range of your product or service, you can conduct a test market. Record the sales as you increase and/or decrease the price in your test market, staging mock sales with your classmates and other students at your school.

Always be confident that depending on the results, you can always adjust the product/service features and raise/lower the pricing.

Also notice we have not yet put an emphasis on cost to produce the product or provide the service. This is a later step, since cost can vary widely depending on the manufacturing method, type of materials, quality of components, etc. Once you are sure of how the product will attract sales, you can find the optimal method to bring costs down to achieve a specific price point that will equally satisfy buyers.

Your teacher will issue Monopoly money to students with which they can make mock purchases. Pass out your advertisement (your successfully surveyed product sheet) to each classmate and make a note of the following:

1. How many classmates came to you to purchase? What percentage of the classmates?
2. How many of the classmates did you have to approach to provide additional information? What percentage of the classmates?
3. How many classmates purchased after receiving the additional information? What percentage of the classmates?

Based on your mock sales results, adjust the price up or down to conduct the test again, making a record of the adjustments. You can repeat this until you have achieved the optimum price point for your offering.

BOOKS/GUIDES:

BusinessWeek magazine

MENTORS:

Kickstarter

SBA SCOR counselors

HQ Pay-As-You-Go Office Space

Bank of America
Merchant Services
Bank of America

U.S. COMMERCIAL SERVICE
United States of America Department of Commerce
Department of Commerce

ACA
ANGEL CAPITAL ASSOCIATION
Various angel investors

5. Sell Your Product or Service

A. OFFER YOUR PRODUCT OR SERVICE BASED ON SURVEYS & TEST MARKETING

Now that you have discovered the demographics (socioeconomic characteristics about your groups of potential customers) of your potential customers, based on your successful test market sales, it is time to make your product or service available on a wider scale. You will find out if these sales mirror your test market sales.

You will target your customers based on the successful sales and demographics, including the following socioeconomic characteristics of those who purchased your product or service in the test marketing:

- Age
- Gender
- Education level

If your classroom is college or university, additional socioeconomic characteristics include:

- Income level
- Marital status
- Occupation
- Religion

Today with the internet, bear in mind the following information:

- Nearly half (46.7%) of US internet users started product searches on Amazon compared with 34.6% who went to Google first (source - May 2018 Adeptmind survey);
- And the leading method among digital shoppers in the US was searching and buying on Amazon (41%) followed by searching on Google then buying on Amazon (28%) (source - February 2018 Salsify survey);
- However, shoppers searching on Amazon took longer to make a purchase than those who searched on Google. On average, 25.9 days spanned search to purchase on Amazon while for Google it was 19.6. Most bought an item within five days, though more (35%) purchased in this time frame using Google than Amazon (19%) (source - Q2 2018 Jumpshot analysis).

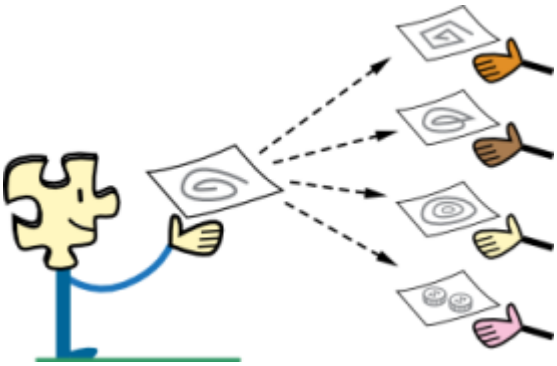
Obviously, listing a product on Amazon makes sense. And Google has a shopping service, as well. But you can also place your products in independently owned stores. Another method is to advertise on various websites, including Google search engine with Google AdWords. With AdWords, you essentially pay for each click on your ad, adjusting the price-per-click you are willing to pay to compete against other advertisers using the same keywords as you.

If your product is a component that can be installed in other products, you can contact manufacturers and send them a sample, remembering to always follow-up with a phone call

after sending samples out. This gives you the ability to resend information if it wasn't received, as well as possibly making a sale if the material was received, read, understood and needed.

Direct marketing is another option, of which you would send out marketing materials including brochures and samples to a targeted market. There are companies that you can purchase mailing lists from that reflect your target demographics.

B. LICENSE YOUR CONCEPT



You might have an interest in the prospect of licensing your product to a company. There are many issues you may want to consider in exploring this option:

1. You (the licensor) might want to market and sell your product to help determine the value, price point and purchasing demographics prior to seeking a license deal. This is because if you have not done this hard work, the licensee can pay you less, since they will have to discover the answers to these issues at their own expense and time;
2. Which party, you or the licensee, will be responsible for litigating in the case of an infringement of the patent? This can be an expensive proposition if you choose to bear this burden;
3. If your product competes with the potential licensee's products, they may *shelve* yours, which means it will never see the light of day. This is sort of a catch-and-kill method companies can utilize to remove *potentially competing products* from the market. So, you may want to consider a *no-shelving* clause in the licensing agreement;
4. While you may receive an up-front nonrefundable licensing fee and/or an advance on royalties, it is said in licensing "It's what's up front that counts." In other words, the money you receive when you sign a licensing agreement might be the only money you'll ever receive. This is especially true in a situation where your product is shelved.

It is always best to consult a licensing attorney when faced with the prospect of licensing your product. A local Small Business Administration SCORE Counsellor may be able to help direct you to a reputable licensing attorney. You can also call the State Bar in the state you reside for a referral to a reputable licensing attorney. Also, there are services like LegalZoom that can assist you.

C. FOLLOW UP WITH PURCHASERS TO OFFER AFTER-SALE SUPPORT

After you have made a sale, don't forget to provide after-the-sale product support. In fact, your product should be developed and designed with servicing in mind. You should design your product so that if it or any component fails, it can be replaced in the easiest, least costly and shortest time period possible.

There are many ways you can follow-up with customers. One way is to call customers and personally see how they are enjoying the product or service they purchased from you. Another way is to send out a postcard in the mail, providing a way for customers to contact you about any issues.

BOOKS/GUIDES:

Wall Street Journal

MENTORS:

Salesforce

amazonfulfillment

Amazon

Other various fulfillment centers

AMI AUTOMOTIVE MANAGEMENT INSTITUTE

Auto dealer service managers