Adventures in Home Brewing

Externship

Brian Holmsten

After thinking about my Externship, and trying to come up with ideas that are unique, interesting, and frugal, I finally hit upon something. What about if I learned how to make my own beer? I could research it – buy a home-brewing kit/set up – learn about different beer and ale styles – go through the steps, and finally make my own batch of beer.

I think this would work.

Planning

Okay, I think the homebrewing idea is a keeper. I emailed Corinne, asking her about the prospects. I took a look on the Internet about homebrewing resources in the area (more on that below). And I picked up a book on homebrewing from the library this past week. It's a rather comprehensive guide that explains about how you do it, what you need, styles of brews, what makes them different, etc. Pretty cool.

I spent some time in the Internet looking up resources, and found a great one in the area. There's a place in Warrenville, on Butterfield Road, called The Brewer's Coop. They have a great website – I was able to download their catalogue of supplies and equipment, find out directions to their store, hours – seems like the exact thing I needed to find.

Okay, let's spend some time clarifying some things.

What makes the homebrewing idea the right one? Well, I believe it fits in well with my Learning Styles Inventory (LSI). I tend to prefer quiet, thoughtful, introspective learning – learning through watching or reading. I tend to like to create abstract concepts, start from nothing and, through my own doing, make something. With brewing beer, following procedures to the letter is crucial. You have to sanitize things; follow directions to the correct temperature; add precise amounts of ingredients; do everything exactly right at the exact right time. It's the sort of structured learning and activity that I generally shy away from. Sure, I can follow directions. But that's not what I'm best at. I'm best at freelancing. Thus, I think brewing will challenge me to do something different, and force me to adapt to how I learn this activity.

I've also decided to make a pale ale. Why make Pale Ale? Why not make Lager? Stout? Scotch Ale? Well, according to the book I'm reading (The Complete Handbook of Home Brewing by David G. Miller), Pale Ale is not only fairly easy to master (key word: master), but tends to work well as an initial foray into brewing. Pale Ale is difficult to screw up, as it were. It tastes great (less filling! - sorry), looks good, and is less demanding than other varieties.

Yes, The Brewer's Coop has the kit for making Pale Ale. Thus, we have a winner.

What do I expect to learn from all of this? Ahh, here's where it gets a bit more complex. Well, obviously, I'll learn how to make my own beer. I'll learn about the equipment needed. I'll learn about the various steps. I'll learn about why each step is done when it is. I'll learn why each step is necessary to the brewing process. I'll learn how the various ingredients add to the character, flavor, and aroma of the beer. I'll learn how to add, subtract, or augment ingredients to change the flavor. I'll learn about the different types of each ingredient (for instance, there are hundreds of varieties of hops, each with their own characteristics). I'll learn about the chemistry involved in turning four basic items (water, hopes, barley, and yeast) into a fermented drink. And I'll learn about how to prepare it for consumption.

But I'll also need to be aware of not only what I'm doing, but how I'm doing it. How am I learning about the chemical reactions? By reading? By watching it happen? By trying something, then screwing up, and observing the consequences? All of the above? How will I determine which combinations of ingredients, and in what amounts, make the best beer? How will I plan this

activity, undertake it, make it work?

This is supposed to be about learning. Like everything else in SNL, it's an exercise in developing the mental muscles that allow you to think, discern, decide, investigate, and explore. It's about doing something new and different, something outside your comfort zone.

I think this will be fun as well as being a learning opportunity (what a cliché – "learning opportunity." I really dislike that phrase, but, regrettably, it fits). I've never done anything remotely like this before. At the very least, I'll enjoy the result!

Oh, yeah, almost forgot – heard from Corinne, she thinks the idea sounds good. All I have to do now is write up the proposal for it. Looking at the form, it seems, . . . well, very theoretical and very obtuse. Not a lot of definitive direction. What do you intend to learn, etc. – wow, that could be interpreted any number of ways. I hate to think that my response and/or reasoning would be juvenile, inappropriate or lightweight. I guess all I can do is write what I think it will be/should be, and go from there. I'm sure Corinne will help if needed – that's what she's there for.

I've also decided that, if for some reason this doesn't pan out as an Externship, I'm still going to buy equipment and try home brewing. I mean, why not? It sounds like fun, it sounds like a great hobby – who says you can only learn something new when it's in conjunction with school?

Onward, you Sam Adams-wannabe!

Okay, wrote up the externship proposal – well, I didn't finish it. I got as much as I could while "winging it." Went to Corinne for assistance – and she got back with some ideas and pointers. On to the revising of it.

The part I'm having difficulty with is the L-11 competency – reflecting what I've learned. It's these abstract concepts that I have trouble with. What do I expect to learn? How to brew beer!

Yeah, but I obviously need more than that. I think I'll learn about the detailed aspects of combining the ingredients – yeah, that sounds like chemistry. I suck at chemistry. Which, I guess, is why I should do this. I'll learn about the effects non-intended organisms might have on the beer if all goes "unwell." That means, if I don't sterilize the equipment properly, I'll end up with tainted beer. Not so good. Hey, that's more chemistry! Plus, a major part of the process is dependent on doing things, adding elements, at precise times and temperatures. Physics! Another science at which I have little skill.

Well, this ought to be a real test.

Sounds like what I'll learn is to take the four basic yet disparate elements and combine them in the exact, precise order and method, and end up with something that won't make you sick to drink.

Sounds like a plan.

Taking my sweet time doing this, aren't I? Well, I've been busy with a few things. Plus, before I can start, I need to investigate what equipment I need, and where the best place is to buy it.

Internet research has led me to believe that my initial impulse was spot-on: The Brewer's Coop, in Warrenville, seems to be the leading place in the area. Great web presence, outstanding selection of both equipment and ingredients, knowledgeable staff, selection of guides, magazines, and books to assist – yup, this is the place.

Now all I need to do is scrape the money together to buy what I need. Approximately $175 should do it.

It's a go!

Sent the completed externship contract/proposal to Corinne, and she accepted it. Next step – well, steps – is to procure the "stuff," and register for the externship.

Registration is via paper/fax. Corinne gave me the name and fax number of where to send it.

I'll go out this weekend to get my supplies.

Step One - The Supplies

Holy smokes! The reality of all this has hit me like Mike Tyson.

Went to The Brewer's Coop on Saturday. Spent about an hour there talking to the guy who owns/runs the place. Really knowledgeable, nice guy. I was able to ask questions like the neophyte that I am, and he was very willing to spend time

with me to make sure my fears and concerns were allayed. We talked about the differences between the two equipment kits – both starter kits, but one, as he said, is for the person who's going to maybe do this once, while the other is for the person who wants to do this for a while and experiment with it. Lower end kit: $69.99. More advanced kit: $109.99.

Yeah, I went for the more expensive kit. That's so like me.

Then we turned to the various ingredients used to make the varieties of beer. It seems so basic – water, barley malt, hops, yeast – there ya go, beer!

Uh, yeah. Dozens of different types of barleys, each of which can be soaked, roasted, dried, or any combination therein. Or, you can use barley syrups, which have already been malted and are ready to use right out of the can.

Hops? Hundreds of varieties from around the world. Plus, do you use fresh hops? Dried? Processed pellets? A combination? And what the hell IS a hop?

Then, it's a matter of what quantities you use of each, how you blend them, when they come in contact with each other, etc.

Luckily, before I started to weep in uncontrolled confusion, he pointed out the ingredient kits. They're pre-assembled and measured boxes that contain the exact ingredients needed to make a particular variety of beer. No guessing, no hand-picking the "right" barley or hops, no "oops."

My hero.

I chose a kit to make Pale Ale. Why Pale Ale? Well, I tend to like that style of beer in general. Popular varieties of Pale Ale available from your local watering hole include Bass Ale, Sierra Nevada Pale Ale, Summit's Extra Pale Ale, and Samuel Smith Pale Ale (my personal favorite beer in existence). Pale ales aren't too light, aren't too dark or "full," have a touch of a bitter, hoppy flavor (yeah, that doesn't sound too goofy – a "hoppy flavor!"), and tend to be a light caramel color.

I'm drooling already.

Okay, perhaps I should take some time to go over the ingredients for beer - what they are, why they're used, etc.

* Water. Okay, sounds basic, right? Well, not really. How good the beer ultimately tastes is, in a large part, dependent upon how good the water is. For instance, it's often recommended that one not use regular tap water. This is due to the wide variability of tap water, and how each individual municipality processes it. My choice was bottled water - well, more accurately, one-gallon bottles of water. Ice Mountain, to be exact. I like the taste of Ice Mountain water. Some bottled waters (i.e. Evian) have a strange, mineral-heavy taste. Some taste rather floral. Ice Mountain is, to me, the best tasting water, so why not use it to make beer that tastes good?

Supplies Needed for HomeBrewing

3-gallon Brew Kettle
Two 5 gallon glass fermentation carboys
universal cap
carboy handle
Bottling bucket and spigot
Siphon hose
Racking cane
Bottle filler
Airlock
Hydrometer
Floating thermometer
14" plastic test jar
8" funnel with strainer
Bottle brush
Carboy brush
Double lever capper
24 12-ounce bottles
24 bottle caps
Sanitizer
5-gallons of water
6-lb. bag of malt extract
1-lb grain
Mesh grain bag
1-ounce of primary hops
1-ounce of finishing hops
yeast

* Grain. The foundation of beer, the grain most often used is barley. Other grains used include rye, wheat, rice, and even corn. In my case, I have an amount of dried, roasted grain to be used

in the initial boiling of the beer. The process of steeping barley in water until it begins to sprout, and then quickly drying the grain, is called malting the grain. Major breweries use malted grains in the creation of their beers. Homebrewers, however, use both grain and . . .

* Malt extract. Approximately five pounds of syrupy malt extract, to be exact. This is the malted grain that has been processed into a thick, sugary, viscous "soup," with approximately 70-80% of the water volume removed. This concentrated malt makes for an easier brewing process for homebrewers or small batch brewers. Different malt extracts, in differing weights and combinations, will lend various primary flavors and aromas to your beer. Malt extract is also the primary carrier of sugars into the beer.

* Hops. Small, green flowers that are shaped like tiny cones. The hops combine a touch of bitterness and floral scent to compliment the sweetness of the malt. Hops also increase the amount of head, or foam, in the finished beer, and act as a natural preservative. In most beers, hops are added twice: once at the beginning of the process, and once again, at the end of the initial brewing to add a final "kick" of bitter edge.

Pre-packaged ingredients for Pale Ale: dry grain, hops, yeast, and malt extract.

* Yeast. Yeast converts the sugars in the beer to alcohol. Without yeast, we'd be making flavored water. Yeast, as a living organism, breaks down the sugar by way of consuming it. The fermentation (when bubbles and foam are created) is the result of the yeast consuming and reacting with the sugars. One note of caution: yeasts do impart a flavor to the beer. For this reason, only use brewers yeast in the brewing process. Never grab that old packet of bakers yeast from the back shelf of the refrigerator!

Step Two - Brew Day

Whoa – a lot more daunting that I had thought.

First of all, there's a nervousness about making sure everything is sanitized properly. Did I do it enough? Correctly? Did I miss a minute speck that will come back to haunt me?

Next is the actual cooking/brewing. I have my nice, new, huge three gallon pot – perfect for brewing up two gallons of wort. But the questions and doubt – did I let the grain steep enough? Did it boil to the correct property? What about when I mixed in the malt – did I over boil it? Under boil it? When the boil was done, there was a ring of malt/hops hanging on the pot, at the line of the original level of liquid. Obviously, the liquid wort boiled down – was it supposed to leave the malt/hop mixture hanging out of the wort?

Aside – the family really didn't like the smell of the brew as it seeped throughout the house. Jeez – just wait until I add the yeast.

Anyway – constantly making sure the next item I use is properly sanitized (the tongs? the wooden spoon? Can I sanitize wood? Damn, did I wreck it all? Damn . . .) . . . . will I have enough sanitization mix?

Ding – time to add the final hops. Whoa – really smelly in here.

Boiling the wort.

Two minutes later – another ding – done. Time to get this concoction down from a boil to a reasonable – what, 70 degrees? Okay, ice bath in the sink. Hope nobody needs to wash dishes.

Add the wort to the carboy – the strainer in the funnel gets clogged with about a pint of liquid to go. Jeez, how much boiled hops and malt is in there? Even "mushing it around" in the funnel (again, is the utensil I'm using sanitized enough?)

won't let it run through. Fine – frustrated – gonna dump the final pint or so. I'll just add less water to the final mix.

Pouring the finished wort into the carboy.

Okay – how do we cap it? Where's the air lock? The carboy closure? What, nothing labeled? Quick – refer to the magazine and the books.

Okay, found what I need.

Make the yeast – damn, touched it with the sanitized spoon, and some yeast stuck to it – but I can't mix the yeast until 15 minutes have passed. Well, it'll live.

What is Wort?

Basically, wort (pronounced "*wert*") is unfermented beer. It's created by initially boiling two-gallons of water with the grains, malt, and hops. At this stage it's a thin, smelly soup. Nobody who looks at a kettle of boiling wort will ever believe that they would someday enjoy drinking it!

Time to take a gravity reading. A lot of numbers on the gravity gauge. Okay, pour some wort into a glass. Hey, gauge won't fit in the glass! Oh – use the tube the gauge came in. Yeah, that makes sense. Okay, that means I have to sanitize it. No wait, I don't – you dump that sample of wort. So, into the tube it goes. The gauge . . . . what's it read? What the hell is 30% Oh – wrong side of the gauge – it says 1.030. Add 1 to the reading, per the directions (temp is 70%, so add 1) – that makes it 2.030. No, wait – 1.031. Okay, that makes sense. Check the directions – it should read about 1.042 or above. Damn – must've done something wrong. Maybe when I dumped the last pint of wort, it was the heaviest stuff. Well, "lite ale" is okay as well. Okay, initial gravity of 1.031 recorded.

Ding. Yeast time. Poured it into the carboy. A bit of a swish to mix (uhm, was I supposed to do that? Seems logical, but, . . .) then place the orange cap on. Take the whole thing downstairs to the wine corner. Attach the fermentation escape tube . . . .

Sigh.

That took a lot longer than I thought.

And my house smells like a brewery.

I want a beer.

Step Three - Fermentation

Hey, look! Bubbles! Okay, so fermentation is taking place – I guess it's working. The way it's set up – with a spill-off-tube extending from the carboy – I thought there'd be more foam in the tube. But nothing. Of course, the carboy's not filled to the top. If it was, maybe then we'd see foam in the tube.

I hope I did this right.

Gravity reading: 1.020. And it smells like beer!

On the flip side, the fermentation has stopped. Was it supposed to stop so soon? Okay, remove tube, put on airlock. But how?

What is Gravity?

Any liquid can be measured by how thick and dense it is compared to the denseness of water. This measurement is called gravity. The baseline gravity reading for water is 1.000: thus, any dissolvable solids which are added to water will make the water thinker, creating a higher gravity reading.Gravity is measured via a hydrometer; this instrument floats in the liquid, allowing the gauge at the apex to be read. This reading is the gravity. Initial gravity readings for most beers will be in the range of 1.035 - 1.050. Final gravity readings, after final fermentation, usually fall to 1.010 - 1.018.

Hmmm. Looks like I need a stopper or cork. No cork in the kit. Now what? Okay, for the time being, I'll re-attach the fermentation tube. Gotta figure out how to get the airlock in place.

Went to Brewer's Coop – found out that the best thing to do is modify the orange cap so the airlock fits inside it. Sure – I was gonna figure that out all by myself.

One exacto knife and three slices later, the airlock fits. Fill it with some water, and there we go.

My continual worry about all of this is that I've somehow contaminated the batch by letting air into the carboy. That's what the airlock is supposed to prevent – air entering the brew vessel. But can't air get in via the tube? And what about when I uncap to pour for the gravity test?

Hey, look! Bubbles! It's fermentation, I tell ya!

Gravity reading: 1.018. Still smells like beer – looks like it too (without the carbonation).

Gravity reading: 1.018. Okay, steady gravity. That means it's probably not going to change any more, which means it's ready to bottle. According to the instructions, the final gravity should be 1.010 – 1.015. DAMN! My batch is too high. Okay, not really too terribly high, but still . . . . does this mean it hasn't worked? Won't work? Did I screw it up somewhere? Probably when I deep-sixed that final pint of heavy, thick wort that wouldn't strain. Or did I boil off too much? Did I wreck the yeast by touching it with the spoon? Did it get contaminated?

Well, at least it still smells like beer. And realistically, there's nothing I can do now - no way of going back in time and correcting my mistakes. Next batch, though, I'll know better.

Step Four - Bottling

So much to do. The gravity has been consistent now for five days - more than enough time to know that it's time to bottle. I just hope that I haven't waited too long. The directions say to bottle once the gravity is steady for at least two days. It doesn't say whether it's good or bad to let it stand for five days at consistent gravity. So, I'm going to forge ahead, insecure in my knowledge that I'm doing my best.

Taking a gravity reading.

To create carbonation in the beer, we need to introduce sugar to the batch, so that the resulting interaction with the yeast causes the necessary carbonation. First step - boil the sugar (included in the kit) in two pints of water for five minutes. Then let cool.

Meanwhile, time to transfer the fermented beer from the carboy to the bottling bucket. All the documentation I've read says to syphon the beer from the carboy. They show how to do it - but they always show it being done with a carboy that's almost full to the top. My carboy isn't even close. Through the loss of volume due to initial boiling, the loss of liquid due to inability to get it through the funnel, and the losses due to gravity readings, I'm about ¾ of a gallon short of the top. Will the siphoning work? Let's give it a shot.

Uh, nope. siphoning not gonna work. Plan B - picking up the carboy - *gently!* - and pouring the beer into the bucket (which, yes, has been thoroughly washed and sanitized). Must do this

slowly, so as to not include the sediment on the bottom.

Okay, so I've transferred four gallons of beer into the bottling bucket. That should allow the sediment to have stayed in the carboy - which, by the looks of it, did just that.

Fermentation cap on the carboy.

Now, the bottles. I need to soak them in the sanitization solution for at least five minutes. Solution: use my large coleman cooler as a bottle tub. Fill with five gallons of water, 5 tablespoons of the sanitizing powder (okay, and extra half tablespoon for good measure), and let the bottles soak. I'm making sure the water gets inside the bottles - I'll literally holding their little heads under the water until they drown - until the little air bubbles escape, then slow, then stop - and the bottles drop to the bottom.

Living "la vida mafia."

And hey, let's put the caps into the bath, too.

The sugar water has cooled down - time to add it to the fluid in the bucket. A few revolutions with the racking cane (sterilized, of course), and it's mixed. Now to let it sit for about five minutes.

While that sits, I can figure out how to connect and work the siphon. I have three pieces of equipment here: a racking cane, a siphon tube, and a bottle filler. They all attach - that much I know. What I don't know is how to get the beer out of the bucket via this snake-like thing.

First, I fitted the bottle filler to the siphon, and filled the siphon full of water. Practice run - yup, the bottle filler works. (Here's how: you insert it into the bottle. By pressing down on the bottom of the bottle, the tab releases the fluid, When you pull the filler out, the tab goes back into "stop" position, shutting off the flow.) Okay, - I need to fill the siphon and bottle filler full of water - and then attach the racking cane - and then make sure there's water in the cane - and then insert the cane into the beer bucket, without spilling any of the water. Yeah, no problem.

First try - water everywhere. Good thing I'm doing this in the laundry room.

Second try - better. Got the cane into the bucket with minimal loss of water. Now a test - does the siphon action work when I release the fluid via the bottle filler?

It does!

And, it makes quite the mess, too. The whole room's gonna smell like beer when I'm finished. Family's gonna love that.

Okay, let the bottling begin.

Take a bottle out of the sanitization bath - rinse it out (carefully), place it on the floor, insert the bottle filler, and . . . .

Well, look at that. My first bottle of beer.

Stop the flow when the beer reaches the top. Remove the filler tube - and the beer level in the bottle falls to the point where the bottle narrows into the neck - the perfect level.

Sterilizing equipment.

Next step - capping the bottle. I dry off the just-filled bottle, and place it on the tray table I have set up in the area. The bottle caps are soaking in the same sanitizing bath as the bottles, so I grab a cap, rinse, and place it on the bottle. Next, I set the capping tool on the cap and bottle - posi-

tioning it so it won't slip or slide - and pull down on the handles. This crimps the sides of the cap, effectively sealing the cap over the mouth of the bottle. Just make sure I give it enough pressure - I don't want any carbonation to escape. My goal isn't to bottle twenty-four servings of flat beer.

Okay - done! There it is - my first, complete bottle of beer, ready to sit and age for a couple of weeks.

Okay, one down, twenty-three to go!

Bottle number 1.

I eventually get this down to a system: pulling the bottle out of the bath, a quick rinse, fill to the top, remove the filler, wipe dry, and cap.

The process doesn't move quickly, despite my new-found confidence. What I find is that by the time I'm on my tenth bottle, the syphon has lost much of the liquid within it, causing the filing process to slow to a trickle. What that means is that I'll need to stop the production line, disassemble the syphon and bottle filler, re-fill it with water, and start the syphon process all over again. Which means the first bottle I fill will be mostly water - so let's get the flow going and use a "dummy" bottle - one that we'll fill, and then empty again for re-use.

There - works perfect. A good, strong flow of liquid.

Okay, time to continue to fill the remaining bottles.

Thirty minutes later, and I'm done. Sitting on the floor in front of me is a case, twenty-four bottles, of my own homebrewed beer. And I hope to God I didn't mess anything up.

What I've discovered is that there are so many points during the process when the brewer can make a mistake and taint the entire batch of beer. Every single item that comes in contact with the beer - every piece of equipment, every utensil, every cap, every container - must be sanitized completely. You can't miss a centimeter. You can't miss under a rim. You can't miss the tip of a handle. You can't miss the one inch inside a tube. You fail to sanitize anything, and it can come back to haunt you.

Plus, there are so many times when the ingredients must be brought together at the exact temperature, or with the exact measurements, that the smallest variance can mean something goes wrong: no fermentation, killing the yeast, etc.

Brewing this beer has been stressful, primarily because of all the attention to the minute details that a person must take during the process - and I'm not a detail person.

Well, now all I can do is wait for two-to-three weeks, and see how it turns out.

It's been a week, and my beer has been sitting in a case in my basement, near my wine rack. You're supposed to age the beer in a cool, dry, dark place - so the wine corner works well. Plus, it's away from the cacophony of daily life - no kids nearby, no dog getting into it, etc. When I went down to check on it (well, nothing to really check on - just looking at it, like an expectant father staring at his wife's swollen belly), my wife asked me when it would be ready to try. I think she's almost as excited as I am.

This is a bit outside the actual "brewing" process, but I think I need a name and some labels for the beer. Something to give it an identity, something to make it less generic. And I think I know what i want to do.

I recently took a picture of our puppy, Oreo, when he was staring into the lens of the camera. It turned out surprisingly good. Perhaps I can immortalize the little guy with a beer label that his scruffy mug graces. Time to open up Photoshop and Illustrator and see what I can do.

So I've taken this picture . . .

and turned it into this label.

Now to print onto some label sheets, apply to the bottles, and I'm all set. Welcome to the wonderful world of "Fuzzy Puppy Pale Ale!"

It's time! It's time to taste the beer!

My batch has spent nineteen days sitting quietly in the corner of the basement, hopefully allowing the yeast to settle and the sugar to turn into carbonation. I put a couple of bottles into the refrigerator yesterday, and today we debut my creation.

Pop the cap - I can hear some fizz, which is good. And it smells like pale ale, which is also good. Now, to pour it into a glass. Yes, no swigging from a bottle here. Since this is unfiltered beer, the yeast has died and settled in the bottom of the bottle. Therefore, you need to pour the beer into a glass, stopping with about a half an inch left in the bottle. That way you don't drink the sediment. It wouldn't hurt you, but it's not really pleasant, and it doesn't add to the enjoyment of the beer.

Well, it's clear, that's good. And it has a head on it, which means the sugar and yeast did indeed create carbonation. Time for a sip.

Yeah, I'm nervous.

Hey, not bad! Kinda tastes like Bass Ale. I wish there was more fizz to it, more carbonation, but all-in-all, not bad. It has a good flavor; you can taste the malt and the hops, and they're balanced well. Nothing too overpowering. Plus, nothing funky or skunky - no signs of taint. I guess I did okay on the sanitizing.

Carbonation

Carbonation is introduced into homebrewed beer by a method called "priming." Priming is simply the process of adding sugar to the fermented liquid. Common priming sugars used in brewing include sucrose, dextrose, glucose, dry or liquid malt extract, and honey. The purpose of the sugar is to create a chemical reaction with the yeast in the fermented beer, which creates carbon dioxide (CO^2). Carbon dioxide gives the beer not only a better presentation when poured into a glass, but it also helps release aromas from the beer and helps balance the flavors within the beer.

The extent of carbonation is measured by volume of CO^2. The higher the volume, the greater the carbonation. The average American lager contains a 2.5 volume of CO^2, meaning the amount of CO^2 dissolved into a pint glass of beer would fill up two-and-a-half pint glasses. This amount is present in the beer before pouring; the CO^2 dissipates quickly once it's exposed to oxygen.

Most major brewers use CO^2 or nitrogen, or a mixture of the two, in the making of their beer. They do not "bottle condition" their beer, this being both unrealistic for brewers making 2 million bottles per day, and unpleasant for the consumers, who would then have sediment in the bottle of every bottle. Major brewers filter the beer, then inject the correct amount of CO^2 or hydrogen into the beer before kegging, barreling, or bottling.

Traditional lagers tend to have the highest volumes of CO^2, while English ales tend to have the lowest CO^2 volumes.

Within about four minutes the head of the beer has dissipated. This is much more quickly than would happen in a normal, mass-produced beer. I guess I didn't have enough sugar, or I didn't have enough yeast. Or both. Either way, the fizz is weakening, and I'm only halfway finished with the glass. Oh well. Something to work on next time.

The finished product -
"Fuzzy Puppy Pale Ale."

Lessons Learned

There were numerous "learning opportunities" throughout this process. However, a few instances stood out as definite challenges to my usual method (or comfort zone) of how I do things, and directly apply to my L-10 competency (Can reflect on the learning process and methods used in an experiential project). My comfort zone, according to my Kolb Learning Style Inventory, is Reflective Observation. I like to watch, read, see how things work. Active Experimentation is where I'm least comfortable (see learning style diagram). Thus, most of this project was in "doing," not in "watching," and in learning through experiencing.

First, I was unaware of the need to sanitize everything that came in contact with the beer. I found myself almost obsessing about this. Why? Because, at almost every step of the process, something comes in contact with the beer. Things you're unprepared for - a wooden spoon to stir, a knife to use in the mixing of the yeast, the tiny white cap that tops the carboy cap - all these items need to be sanitized carefully and thoroughly. And those are the key phrases that caused stress: carefully and thoroughly. On your first attempt at sanitizing an item, you're never quite sure if you're doing it right. Do I have enough sanitizing powder? Am I letting it sit in the sanitizing solution long enough? Am I getting every little crevice and edge sanitized? Most directions said to sanitize the equipment: it didn't say how to sanitize it, or how long to sanitize it, or if there are any ways in which to expedite or insure the sanitization. I think a person could spend more time sanitizing equipment than actually brewing the beer. At some point, you have to decide that you did as good as you could, and move on. That's what I was eventually forced to do: figure it out, and make my own decision.

Another issue was in the temperature control of the wort and beer. I discovered through my research that almost all aspects of the brewing process can be inhibited, or worse yet destroyed, by imprecise temperature control. In almost every case, an ingredient must be added to the batch when the liquid is at a certain temperature (or within a temperature range). It's not enough to add yeast to the wort after it's cooled; you need to make sure the temperature is lower than 75 degrees, but no lower than 65 degrees. Should you add the yeast when the temperature is too high, the yeast will be killed. Add the yeast when the temperature is too low, and the yeast will fail to activate properly. Thus, when the wort comes off the boil, you need to cool it down, both quickly and accurately. You cannot assume the temperature: you need to take repeated temperature readings, and make sure the liquid is at the precise stage before adding the yeast.

Again, you need to figure out how to cool it down. Ice bath? Placing the kettle in the refrigerator? Leaving it outside in the cold garage? Sure, any of these might work, but what about the sanitized and controlled liquid contained? You can't really cool the wort down by leaving the pot outside for two hours - the beer could get tainted. Thus, you choose a method - ice bath - you proceed, and you check the temperature religiously, almost obsessively.

Similarly, taking gravity readings requires strict adherence to temperature as well. Gravity

readings are to be made at 70 degrees; take the reading at a higher temperature, and you'll need to add to the reading. Thus, you spend considerable time taking temperatures, checking temperature, and seeking the right environments in which to store and ferment your beer.

In fact, I spent a considerable amount of time thinking about, and planning for, the minutiae of the brewing process. I had to make it a habit to check on gravity and temperature readings every day, even when it wasn't convenient. Plus, I had to make sure that I was taking the time to do it all precisely. I had to slow down my thought processes and be exact: pour the liquid into the vial, then check the temperature. To get a correct reading, you had to let the thermometer sit in the liquid for about 15 minutes - no rushing. Then, once you had the exact temperature, you could take the gravity reading. Again, you had to be exact: there's a difference between 1.018 and 1.019, and you had to make sure you had the correct reading. It was a matter of controlled, detailed effort - the type of work I'm unaccustomed to excelling at.

You can't read about it, you can only do it!

Even when many of the steps in the process are completed, you still need to watch the product, and make decisions on a daily basis about how to proceed on to the next step or the next day. How is the fermentation going? Too many bubbles? Not enough? You can read all you want about the process, but until you see it, experience it, live through it, and take steps to work with it (or change course), you can't get a feel for what you're doing or creating. Even then, there's still an uncertainty involved: did the beer get tainted at any point? Are the ingredients reacting correctly, and producing the desired outcome?

What about the yeast as it dies and settles in the bottom of the carboy, or in the bottom of the bottles? Well, you need to plan for that, and take steps to segregate the cloudy, dead cells from the useable product. My tendency would be to simply dump the liquid from the carboy to the bottling bucket. Knowing that there was sediment on the bottom of the carboy, I needed to take the time to rack the liquid from one vessel to the other, leaving the sediment behind. Similarly, I needed to remember to let the liquid sit still! Constant agitation will not let the sediment settle, creating a cloudy beer. This holds for both the fermentation process and the final bottling. Once the beer has been bottled, you need to let it sit so the sediment created by the sugar/yeast interaction will fall to the bottom, leaving a clear liquid. Then, when you pour the beer into the glass (no chugging from the bottle here!), the sediment remains behind.

Yet, letting the liquid sit still seems unnatural to me. After all, my first impulses are to mix it, and make sure all of the elements and ingredients are combined as carefully as possible. This was one instance where I had to resist my impulses, and keep a "hands-off" stance.

The final lesson that was driven home to me here is that the making of beer is both a science and an art. You need to have certain ingredients, and you need to know how each one will impact and react to the other. You need to know the acid content of various malts and hops, and how those acids will impact the flavor. You also need to know how much of each ingredient you need - precisely - for each gallon of water you intend to use. Any variation can change the entire tenor of the finished brew.

Yet, it's by experimenting with ingredients - adding a different type of hops, or combining two or three different hops varieties - that the art enters the process. It's much like adding shades of color to a painting, or adding instruments to a symphonic piece of music. The texture changes, the experience for the consumer changes, and the end result can become entirely different. I never knew that different waters could affect the flavor of beer - yet by making additional batches, and changing the type of water used, you can definitely discern a difference, even when using the

same grains, malts, and hops.

You can read all about how different beers and styles of beer and ale are made. You can even read books that are basically recipe books for brewing different beers (see references). But the words on the page are lifeless and meaningless when it comes to creating something as unique as beer. The only way to truly learn how beer is created is by diving in and doing it.

I did begin this project by reading various books and magazines about beer making and homebrewing. I tried to learn about the ingredients, the chemical reactions that would (hopefully) take place, the correct methods and times to combine elements to create the product. But when it came time to actually making the beer, all that I read was virtually useless. The only way to do it is to do it. I could collect knowledge about the product and process, but it was latent without the experiential aspect of getting my hands dirty and boiling wort, adding yeast, and fermenting beer.

You cannot learn how to make beer by reading about it, nor by watching others do it. You can only learn this by doing it. And if you fail, you figure out why and at which step, you plan to correct the mistake on the next batch, and you try it again. As I'm doing right now.

I've always heard the term "craft brewers" used to describe those who make smaller batches of beer - usually microbreweries. What I now understand is that "craft brewers" means more than just small-run brewers. It describes a way of brewing beer that includes carefully controlled experimentation, and using an intimate knowledge of the ingredients to create something just a bit different from the mass-produced beverages that are ubiquitous in our society. Craft brewers are so confident and versed in the science of the brewing that they can concentrate on the craft, the art, of it. Their talents allow them to mix and match scents, flavors, even textures, to find a signature beer that they can call their own, akin to a builder customizing one house on a block, or a band remaking a song with it's own signature sound.

What I learned, more than anything else, is that beer is simply a liquid palette on which an artist can use his or her tools and expertise to create something extraordinary - and something extraordinarily different and personal. And I think it's this realization that reflects on the second competency of this externship, L-11: Can design and apply appropriate learning strategies for creating a homebrewing facility and creating an exceptional home brewed beer and/or ale. You learn the science, you learn the basic techniques, and then you not only apply it, but massage it to make it your own.

It was a joy doing this. It shook the way I do things, and made me take more of an active role in how I spend my time (and how I learn). I felt as though I had control over what was being made, and I had control over what the next step would be. I could read about beer making and experience the vicarious thrill of a perfect batch being made. I could go to a brewery or microbrewery and see the beer being fermented, and then have a taste of the product as it comes out of the aging tanks. But I couldn't put my imprint on it, as you can when you jump in and make it yourself. While I could learn about how beer is made in a passive manner, it would be hollow, as I wouldn't be feeling how it's made, or crafting it myself. I had to experience it - no matter how difficult it might've been.

I experienced it. And I'm better for it.

Reference Materials

The following books, magazines, and articles were instrumental to me in the understanding of what homebrewing is all about, and the process of creating my own home brew.

Papazian, Charles. The Complete Joy of Homebrewing (Third Edition). New York: Harper Collins, 2003.

Miller, David G. Dave Miller's Homebrewing Guide : Everything You Need to Know to Make Great-Tasting Beer. North Adams, Mass.: Storey Publishing, LLC., 1995.

James, T.C., Campbell, S., et.al. “Transcription profile of brewery yeast under fermentation conditions.” Journal of Applied Microbiology 94 (2003): 432-448

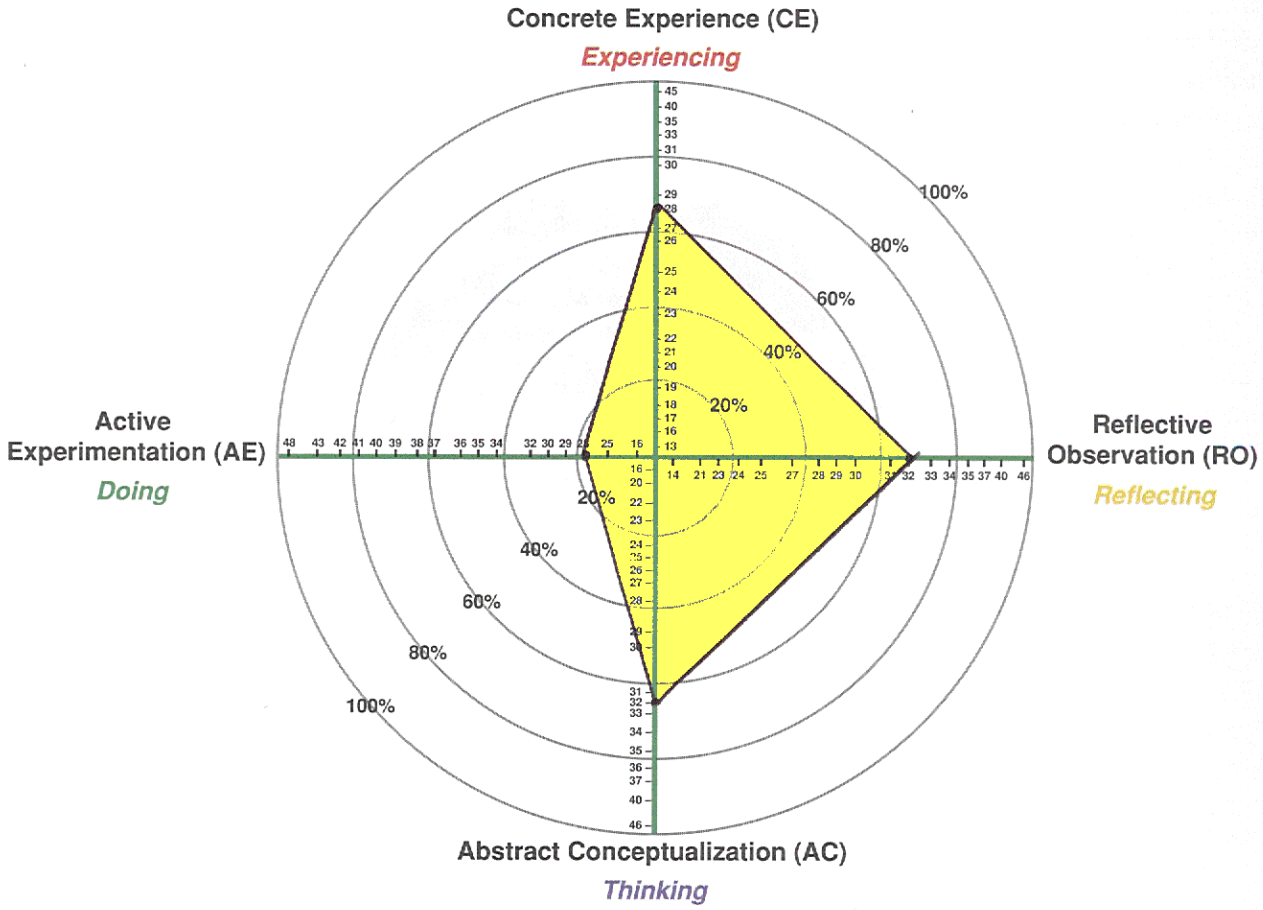
Lutzen, Carl F and Mark Stevens. Homebrew Favorites : A Coast-to-Coast Collection of More Than 240 Beer and Ale Recipes. North Adams, Mass.: Storey Publishing, LLC., 1994.

Nachel, Marty. Homebrewing for Dummies. New York: For Dummies, 1997

Zymurgy: The Journal of the American Homebrewers Association. Sept/Oct 2005.

The Cycle of Learning

On the diagram below, mark a dot on the corresponding line to indicate your CE, RO, AC, and AE scores. Then connect the dots to form a kite-shaped pattern on the diagram.



Your scores indicate how much you rely on each of the four different learning modes: Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation. These learning modes make up a four-phase cycle of learning. Different learners start at different places in this cycle. Effective learning eventually involves all four phases. You can see by the placement of your dots which of the four learning phases you tend to prefer in a learning situation. The closer your dots are to the 100% ring on the circle, the more you tend to use that way of learning.

Another way to understand the placement of your dots is to compare them with the scores of others. The percentage labels on the concentric circles above represent the norms on the four basic scales (CE, RO, AC, AE) for 1,446 adults ranging in age from 18 to 60. This sample group contains slightly more women than men, with an average of two years beyond high school in formal education.

A wide range of occupations and educational backgrounds is represented. On the vertical line in the diagram above, find your score for Concrete Experience. For example, if your score was 27, then you scored higher on CE than 60% of the people in this sample group. You can compare your scores for each of the other learning modes with the sample group.