Science of Jewelry – Reflective Teaching Portfolio

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This reflective portfolio is for an interdisciplinary course (*Science of Jewelry*: SC 148) that was taught by Steven Parker in the Jewelry Department and me in the Spring 2016 semester. The first part of the portfolio is a summary of what was taught during the semester. That is followed by more information and a reflection about each of the 15 classes.

Because registration for the course was in two departments (Jewelry and Science and Mathematics) with enrollment limited to eight students for each department, the students were of two populations – students who have taken courses in the Jewelry Department, some of which were taught by Steven Parker, and students who had no previous experience in jewelry who were taking the course to satisfy the college's science requirement. Knowing before the course began the jewelry experience and probable background students might have in physical science and mathematics, we began **Class 1** by teaching basic mathematics (metric system, scientific notation) and physical science and general chemistry (stable elementary particles, fundamental forces of nature, atomic theory, Periodic Table of the Elements) and safety procedures needed for the laboratory portion of the course [knowledge of Manufacture's Safety Data Sheets (MSDS), wearing of goggles and protective clothing, emergency procedures in case of an accident]. After the first class, we agreed that this was a reasonable way to begin the course and that for **Class 2** we would introduce chemical bonding of elements, which is relevant for the laboratory activity that week when sterling silver would be made by each student, and phase diagrams for silver and copper alloys.

The lecture for **Class 3** was devoted to electron orbitals and phase diagrams for an alloy of silver and copper, commonly known as sterling silver. The instruction was complemented by powerpoint presentations that the students could access and review in Blackboard; the laboratory assignment also was available on Blackboard. Two quizzes were given to assess the students' understanding of chemical bonding and the MSDS. Following the class, we decided to have students work in groups of two, pairing a student who had taken a laboratory jewelry course and a student who had no previous experience working with the equipment in the laboratory.

Class 4 began with a quiz about electron orbitals that was taught the previous week in the lecture. Because **Class 5** would be an off-campus field trip to the halls of

Meteorites and Minerals and Gems at the American Museum of Natural History (AMNH), information about the museum was provided in the lecture as background for the trip. The information included the types of meteorites on display (undifferentiated and differentiated), and gold. Although the field trip was done as a class activity accompanied by us, each student was required to do a written assignment about meteorites. Because gold alloys with iron and iron is the major element in Earth's core and in meteorites, the field trip was relevant for our course because students learn why there is a scarcity of gold in rocks at Earth's surface. Also, students saw first-hand the specimens that comprise the mineral and gems collection at the museum, which is one of the world's most important.

As just noted, **Class 5** was held at the AMNH. In the Hall of Minerals and Gems, students were required to watch the video *Forever Gold* because the history and use of gold as jewelry would be among the lecture topics in classes 6-9. Following the trip to the AMNH, we agreed that the field trip was a worthwhile activity because it added to the students' knowledge about gold. Equally valuable, students would be more aware of the excellent scientific resources at the museum that for understandable reasons we do not have in the Jewelry and Science and Mathematics departments at FIT.

In the lecture for **Class 6** we added to what the students learned at the AMNH and made a presentation about platinum. Other topics were the definitions of minerals and rocks and methods to identify them in hand samples. The methods include color, taste, streak, luster, hardness crystal habit, density, odor, magnetic properties, and breakage (cleavage or fracture). In the laboratory the students continued to work with their ingot of sterling silver.

Class 7 was devoted to the Platinum Group Metals (platinum, palladium, iridium, and ruthenium) and to the classification of rocks (igneous, sedimentary, and metamorphic) and examples of three rock formations commonly used as facing on NYC buildings. The formations are Stony Creek Granite (pink granite that is the outside of the original AMNH), Manhattan Formation (bedrock in Manhattan and rock used in the construction of the gothic buildings at the Convent Avenue campus of the City College of New York and Union Theological Seminary), and Indiana Limestone (facing of FIT buildings A and D, Rockefeller Center, Empire State Building, Metropolitan Museum of Art, Riverside Church, Grand Central Station, Cathedral of St. John the Devine, Waldorf-Astoria Hotel, and numerous other landmark buildings in Manhattan). Each student was required to write a summary of the geologic history and physical properties of the three rock formations that was due the following week. The laboratory activity was a local field trip in the vicinity of FIT to observe the three rock formations, ending at the U.S. Post Office at 34th Street

and 8th Avenue. Because of the small size of the class, it was possible to keep the students together when discussing the rocks during the trip, and to observe the students' level of interest and comprehension of the subject matter.

The lecture in **Class 8** was devoted mainly to the mining and processing of gold including a discussion about the hazards gold miners might face in their vocation. Two videos about gold mining in Peru were shown, and the students were directed to a powerpoint about steel and non-ferrous metals (copper, zinc, tin, nickel, lead) and their alloys (bronze and brass). There are links in the powerpoint about phases of steel, heat treatment, case hardening, annealing, tempering, color changes during heating, and the uses of steel by jewelers. In the laboratory, the students continued tooling and testing the physical properties of sterling silver.

The first half of **Class 9** was a presentation about the Gold Group Metals (gold, silver, copper, and lead). The second half of the lecture was about the sustainability and ethics associated with the mining of the Gold Group Metals, especially of gold. In the laboratory more experiments were done with sterling silver to learn the effects of heat treating the silver alloy.

The lecture of **Class 10** began with a powerpoint presentation about alternative materials used by jewelers. The materials include precious and semi-precious stones, stainless steel, tungsten and tungsten carbide, titanium, niobium, aluminum, ceramics, and glass. For the students having a particular interest in those materials, there were 25 links about their properties and use. The remainder of the lecture was a presentation about the genesis of ore deposits with special attention to hydrothermal deposits of gold and silver. In the laboratory, the students age hardened sterling silver and did a variety of laboratory experiments and measurements with their samples.

The first half of the lecture in **Class 11** was about inorganic and organic stones used by jewelers. That was followed by a review of acids and bases as an introduction for calculating the equilibrium constants needed to determine the amount of silver in solution required to form an ore body that contains 1000 British tonnes (22,000 U.S. pounds) of silver. As background for soldering that was done in the laboratory in this class, students also learned the chemistry of fluxes that are used in the jewelry industry. In the laboratory, each student soldered the sterling silver alloy they had rolled into narrow strips 2-mm thick earlier in the course.

Heat, temperature, heat transfer (conduction, convection, and radiation), Second Law of Thermodynamics, and Gibbs Free Energy were topics during the first half of the lecture in **Class 12** as an introduction to the cause of combustion of

diamond that will be a topic in **Class 13**. The second half of the lecture was a presentation about gemstones used in the jewelry industry and giant covalent molecules (diamond and quartz). The physical and mineralogical properties of diamond and graphite, both of which are pure carbon, were compared to show it is not the chemical composition but the atomic structure of a mineral that is the controlling factor in its physical properties. The Gibbs Free Energy (ΔG) of - 94 kilocalories/mol for diamond was calculated by each student to show that diamond when heated is an exothermic (spontaneous) reaction. Gary Roskin from the FIT Jewelry Department and International Colored Gemstone Association (ICGA) attended the lecture and discussed the ethics of the retail jewelry industry and identity of respected suppliers of gem quality jewelry. In the laboratory, students did experiments with steel similar to those that were done in previous labs with sterling silver.

Class 14 began with a lecture about steel and iron, and plating ferrous and non-ferrous material. That was followed by lectures by Karen Pearson from the FIT Science and Mathematics Department about the chemistry of glues and other adhesives used in the jewelry industry, and by Michael Coen from the Jewelry Department about laboratory equipment that is used routinely to identify gemstones. The laboratory portion of this class was devoted to finishing the sterling silver and steel/iron assignments that are required in the course.

Class 15 was about the Theory of Plate Tectonics, which was a powerpoint presentation complemented by handouts about paleomagnetism. The class ended by each student doing an assessment of the course using the SALG (Student Assessment of Learning Gains) guidelines and philosophy. The SALG has 22 questions that require a written answer. The anomalous responses were delivered by a student to the Jewelry Department for viewing by us after the final grades are determined.

Upon completion of the course, the students were able satisfied the following requirements as stated in our proposal for teaching *Science of Jewelry* as an interdisciplinary course.

Apply safe practices in the laboratory.

Understand methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.

Analyze scientific data, concepts, and models in chemistry and earth science.

Compare current and historical ways in which materials have been used in the jewelry industry.

Evaluate the economic impact of precious metals throughout history and sustainable and ethical sourcing of gem quality material.

Describe the geologic origins of rocks, minerals, and gems, and the environmental impact of mining to the land and sea in areas of land use, ground water contamination, hazardous chemical containment, and endangered species.

Classify the physical properties and science of metals and alloys.

Summarize the chemistry of acids, plating, cements, resins, and patinas.

Interpret lecture material as practical laboratory applications.

Class 1 – January 27, 2016

In a jewelry course that has a lab component every week, as ours did, it is important that the students understand and practice safety and the procedures to be taken should an accident occur when using tools and chemicals. The Material Safety Data Sheet (MSDS) contains basic information about hazardous chemicals to insure the safety and health of the user and emergency responders at all stages of a chemical's manufacture, storage, use, and disposal. Besides for students, the MSDS is intended for employees occupationally exposed to a toxic substance, whose facility uses the substance, and emergency responders who have to deal with injury or damage caused by the substance. The MSDS is kept in a readily accessible location where the substance is being used, and it is obtained from the manufacturer or distributor as either a hard copy or online. Because the MSDS is technical and often very detailed, we explained the eight sections and glossary of abbreviations in the Sheet. The link for materials approved for use at FIT is http:// msds.fitnyc.edu/ MainMenu.aspx?fm=0&tb=0.

The topic for the remainder of lecture was the Periodic Table of the Elements. We began by defining elements, compounds, ions, and chemical bonds. The bonds that are important in this course are ionic, covalent (non-polar and polar), and metallic. We defined atomic number, atomic mass, configuration of electrons in orbitals around the nucleus, and groups (columns) and periods (rows) on the chart. The classification of elements into metals, non-metals, metalloids, and electron affinities of pairs of elements was also explained.

Class 1 Reflections

Although we know a lot of information was given to the students in the first lecture, we believe that a working knowledge of the MSDS and a basic understanding of general chemistry are needed before entering the laboratory and preparing an

alloy of silver and copper (sterling silver), which would be done in Class 2. We think we achieved these objectives, and were pleased that all of the students were present to receive the instruction.

Class 2 – February 3, 2016

Because each student in the laboratory would make a sample (ingot) of sterling silver from a mixture of 92.5% silver and 7.5% copper, it is important to know the structural properties of a crystalline material and the types of crystals that can form when metals or combinations of metals are heated. This can be observed in a phase diagram, which we explained during the lecture prior to entering the lab. We provided several links that showed a simulation of microstructure grain growth of a 2-dimensional grain structure, and a simulation of grain growth in 3-dimensions. Each student would be tooling (rolling and drawing) the sterling silver sample he or she made so we explained what occurs during elastic and plastic deformation, annealing, and work hardening. We believe this knowledge is necessary to understand the physical changes in metals when using them to manufacture jewelry.

The lecture ended talking about ionic and covalent chemical bonds, citing several examples of each. Sodium chloride (NaCl: halite – salt) is a common crystalline solid formed by an ionic bond, and carbon dioxide (CO_2) forms by a covalent bond.

In the laboratory, Steven Parker demonstrated how an ingot of sterling silver is made from 92.5% silver and 7.25% copper. There are several steps using heat that the students must understand. Each student will make an ingot of sterling silver in Class 3.

Class 2 Reflections

Using the videos in the links in the powerpoint to show crystal growth is a good way to demonstrate this physical process, especially for FIT students who are excellent visual learners. Although phase diagrams can be difficult to understand, knowing how to interpret them gives meaning to what is occurring at the molecular level when crystals form. Also, seeing how an ingot of sterling silver is made by a jeweler is instruction the students need for the lab in Class 3. Thus, we feel that the students benefited from the instruction this week and are aware of the safety procedures required when heating metal to form an alloy such as sterling silver.

Class 3 – February 10, 2016

The first half of the lecture was a powerpoint presentation about the types of gold deposits that are mined. The two most important ones are reef deposits and placer deposits. Reef deposits are concentrations of quartz veins that contain gold and other precious metals, mainly silver, that are mined far below the earth's surface. Placer mining is done in streams by panning for gold with a tray, sieve, or sluice. The powerpoint has five links the students were asked to view about issues surrounding the safety and ethics of gold mining.

The second half of the lecture was about electron orbitals s, p, d, and f surrounding the nucleus of an atom. An understanding of the orbitals is important when studying the formation of compounds and their physical and chemical properties.

In the laboratory the students saw Steven Parker make sterling silver and describe the safety procedure to be followed.

Class 3 Reflections

Because gold is such an important metal in the jewelry industry, having a thorough knowledge of its properties and source in nature are fundamental topics in a course about the science of jewelry. Because of the safety involved when heating metals, it is critical that the work of the students be carefully watched and that a student with prior experience doing this is partnered with one who has never done it.

Class 4 – February 17, 2016

The lecture began with a powerpoint about the mining and processing of gold, silver, platinum, and gemstones beyond what was taught in Class 3. There were three links describing mining in Bolivia and Mexico about gold mining that the students were asked to see.

Because Class 4 would be a trip to the American Museum of Natural History to do an assignment at the Hall of Meteorites, background information about meteorites was given to the students so they would better understand the exhibit.

In the laboratory, Steven Parker demonstrated experiments with sterling silver that the students would do with their ingot later in the course.

Class 4 Reflections

Preparing students for a trip to the American Museum of Natural History by explaining some to the things they will see is important because in places in the exhibit the terminology about meteorites is technical and can be confusing. Also, for students to see a skilled jeweler tool sterling silver in the laboratory aids them when they will be doing it with their ingot in future labs.

Class 5 – February 24, 2016

The class this week was held at the American Museum of Natural History in the Hall of Meteorites. In addition, students were required to watch the video *Forever Gold* in the Hall of Minerals and Gems because the history and use of gold as jewelry are central topics in the course.

As part of the class this week, the students were required to watch on Blackboard two powerpoints, one about silver starting with its discovery in Turkey about 5,000 years ago and in Peru about 4,000 years ago. Silver was used as currency in Asia Minor and North Africa beginning about 3,000 years ago and was designated the official currency of the Roman Empire in 269 B.C. About 150 years ago compounds of silver began to be used in medicine and especially in photography.

The second powerpoint was about the chemistry and physical properties of silver and silver alloys, one being sterling silver that the students are working with in the laboratory. The powerpoint contains information about heat treating, polishing, and soldering silver and its alloys that are relevant to assignments in the lab.

Class 5 Reflections

Following the trip to the AMNH, we agreed that the trip was a worthwhile activity because it added to the students' knowledge about gold. Equally valuable, students would be more aware of the excellent scientific resources at the museum that are not in the Jewelry and Science and Mathematics departments at FIT.

Class 6 – March 2, 2016

The lecture began with information about platinum, which is another precious metal used by jewelers. The earliest use of platinum for which there is a record was about 2,500 years ago in Egypt, and in South America platinum was used in Columbia about 300 years later. The Spanish thought that platinum is useless so they placed no value on it. Eventually the value of platinum was realized and in the mid-18th century the French made platinum the only metal fit for Kings. Today, the largest platinum deposit is in South Africa near Johannesburg.

The second half of the lecture was about methods to identify a mineral, which is a naturally occurring inorganic compound that has a definite crystal shape and chemical composition. The methods include color, taste, streak, luster, hardness crystal habit, density, odor, magnetic properties, and breakage (cleavage or fracture).

In the laboratory the students continued to work with their ingot of sterling silver.

Class 6 Reflections

To help the students identify minerals during the lecture, we shared hand samples of common minerals that everyone could observe. Even with the limited number and variety of minerals in the FIT teaching collection, to be able to hold a hand sample has value, and for the more attractive ones (crystal quartz and garnet are examples), the crystals appeal to students majoring in jewelry design and manufacture.

Because tooling a sterling silver ingot is time consuming when properly done, it might take several hours for a student to finish his or hers. In order that students would not have to wait for the equipment to do the tooling, a group of students worked together to complete at least one or two ingots in the time available. That seemed to work well so interest in the lab activity is maintained for everyone.

Class 7 – March 9, 2016

The first half of the lecture was about the physical properties of Platinum Group Metals (platinum, palladium, iridium, and ruthenium). The properties include density, melting point, malleability, ductility, thermal conductivity, and heat expansion. Platinum has value as a catalyst in the automobile industry and as an alloy in casting and metal fabrication.

The second half of the lecture was about rocks that are common to the NYC metropolitan region (Manhattan Formation, also called Manhattan Schist, and Inwood Marble) and that can be seen in the FIT neighborhood along with two other important rocks (Indiana Limestone and Stony Creek Granite) that are used for facing buildings. Following an introduction about the rocks, the class took a field trip in the vicinity of FIT to see the rocks on buildings or in the sidewalk.

Class 7 Reflections

The field trip began in the lobby of the FIT Feldman Building that has red marble on the walls and ended at the U.S. Post Office at 34th Street and 8th Avenue. Because of the small number of students in the course, it was possible to keep the students together when discussing the rocks at each site, and to observe the students' level of interest and comprehension of the subject matter. As is true for the field trip to the American Museum of Natural History to see the meteorite and mineral collection, the students seemed to enjoy and benefit from the field trip this week.

Class 8 – March 16, 2016

The lecture began with a powerpoint about mining and processing of gold and was followed by two videos about gold mining in Peru that prompted a discussion about the hazards gold miners might face in their vocation. The students then were directed to a powerpoint about steel and non-ferrous metals (copper, zinc, tin, nickel, lead) and their alloys (bronze and brass). The powerpoint had links for information about phases of steel, heat treatment, case hardening, annealing, tempering, color changes during heating, and the uses of steel by jewelers.

Class 8 Reflections

In the laboratory, the students continued tooling and testing the physical properties of sterling silver. As was done in the laboratory for Class 7, the students worked cooperatively, sharing equipment and comparing results between each other. This produced a positive environment for the lab, and allowed the students who had fallen behind an opportunity to catch up.

Class 9 – March 30, 2016

The first half of the lecture was a powerpoint presentation about the Gold Group Metals (gold, silver, copper, and lead). The second half of the lecture was about the sustainability and ethics associated with the mining of this group of metals, especially of gold.

In the laboratory more experiments were done with sterling silver to learn the effects of heat treating the silver alloy.

Class 9 Reflections

In the laboratory additional experiments were done with sterling silver to learn the effects of heat treating. Again, group work was encouraged so the students could compare results and learn from each other with assistance from Steven Parker and me.

Class 10 – April 6, 2016

The lecture was of two parts. It began with a powerpoint presentation about alternative materials used by jewelers. The materials include precious and semi-precious stones, stainless steel, tungsten and tungsten carbide, titanium, niobium, aluminum, ceramics, and glass. For someone with a special interest in those materials, there were links about their properties and use. The second half of the lecture was about the genesis of ore deposits with special attention to hydrothermal deposits of gold and silver and a review of the controversy between believers of Neptunism championed in Germany by Werner and Plutonism proposed by Hutton in Scotland. Today, Plutonism is the favored hypothesis for the origin of most ore deposits.

In the laboratory, the students age hardened sterling silver and did a variety of laboratory experiments and measurements with their samples.

Class 10 Reflections

By presenting the two very different hypotheses [Neptunism (water origin) and Plutonism (volcanic origin)] for the genesis of major ore deposits showed the students how scientific thought evolves and the influence strong personalities can have on some beliefs. Knowledge about age hardening that was done in the

laboratory is critical when fabricating jewelry, so the experiments the students did with their sterling silver sample have value.

Class 11 – April 13, 2016

The first half of Class 11 was a powerpoint about inorganic and organic stones used by jewelers. The most common inorganic stones are bone, teeth, amber, sea shells, and pearls, with shells used for ornamentation more than 100,000 years ago. During most of early history, the user of stones was restricted to royalty and the aristocracy. In the Byzantine Empire and in France and England, commoners were forbidden by law from wearing any jewelry of gold and silver, and only the Byzantine Emperor could wear pearls, emeralds, and sapphires. Pearl, when mixed with wine, juice, lemon, and spices was believed to cure illnesses or be an aphrodisiac. Only the wealthy could afford these luxuries. Birthstones are an invention 1912 by the National Association of Jewelers to sell stones. There are many imitations of gemstones that are also used, even by royalty as long ago as 1300 in England. Precious stones are diamonds, rubies, sapphires, and emeralds. Diamond did not become popular as ornament for women until the mid-15th century. At the end of the 19th century, the best pearls reached the value of the some of the finest diamonds.

The second half of the lecture was a review of acids and bases as an introduction for calculating the equilibrium constants needed to determine the amount of silver in solution required to form an ore body that contains 1000 British tonnes (22,000 U.S. pounds) of silver. As background for soldering that was done in the laboratory in this class, students also learned the chemistry of fluxes that are used in the jewelry industry.

In the laboratory, each student soldered the sterling silver alloy they had rolled into narrow strips 2-mm thick earlier in the course.

Class 11 Reflections

The students worked in groups of three or four when soldering their sterling silver. As was beneficial in the previous labs, students who had experience in gemology helped those who had never soldered.

Class 12 – April 20, 2016

The lecture was about how stones used in the jewelry industry react to the most common manufacturing processes. The easiest way to avoid damaging stones is to fit and prepare all settings before assembly and pre-polishing, and then pre-polish to an almost final finish before the stones are added. Sometimes this is not the most efficient practice in production, so it is useful to know which stones can and cannot survive various manufacturing processes. Care must be taken when setting, soldering, casting, and finishing stones so they are not damaged and lose value. The specifics of each of these processes are not the topic of this curse, but provide some information in the powerpoint that accompanies this lecture.

Heat, temperature, heat transfer (conduction, convection, and radiation), Second Law of Thermodynamics, and Gibbs Free Energy were topics during the second half of the lecture as an introduction to the cause of combustion of diamond that will be a topic in Class 13.

In the laboratory, students did experiments with steel similar to those that were done in previous labs with sterling silver.

Class 12 Reflections

As has been done during the semester, this week the students worked in groups of three or four when doing their experiments with steel where students who had prior experience with steel helped those who had never soldered.

Class 13 – April 27, 2016

The lecture began with a powerpoint abut electroplating in the jewelry industry. Electroplating is the process of coating an object with metal by placing the object in a solution of the desired metal and passing an electrical current through both the object and solution. As is true for the first topic in Class 12 about how stones must be treated in the manufacturing process, electroplating and subtopics such as electroforming, electrocleaning, and electropolishing are not part of the course. Still, we provide this information for the students who might decide to become a certified gemologist or jeweler.

Giant covalent molecules (diamond and quartz) were the topic for the second half of the lecture. The physical and mineralogical properties of diamond and graphite, both of which are pure carbon, were compared to show it is not the chemical composition but the atomic structure of a mineral that is the controlling factor in its physical properties. The Gibbs Free Energy (ΔG) of - 94 kilocalories/mol for diamond was calculated by each student to show that diamond when heated is an exothermic (spontaneous) reaction. The lecture concluded with a presentation by Gary Roskin from the FIT Jewelry Department and International Colored Gemstone Association (ICGA). He discussed the ethics of the retail jewelry industry and identity of respected suppliers of gem quality jewelry.

Class 13 Reflections

In the lab this week the students continued to work in groups of three or four to finish their experiments with steel. The students appreciated the information Gary Roskin gave to them so he will be invited to give the same presentation when the course is taught again.

Class 14 – May 4, 2016

The lecture began with a powerpoint about finishing stones and the abrasives, polishes, and tools jewelers use. Specifics of the methods apply to more advanced courses in gemology but we provided them as basic information and links for students who are thinking of a career in gemology.

The remainder of the lecture was about steel and iron, and plating ferrous and non-ferrous material. That was followed by guest presentations by Karen Pearson from the FIT Science and Mathematics Department about the chemistry of glues and other adhesives used in the jewelry industry, and by Michael Coen from the Jewelry Department about laboratory equipment that is used routinely to identify gemstones.

The laboratory portion of this class was devoted to finishing the sterling silver and steel/iron assignments that are required in the course.

Class 14 Reflections

The presentations by Karen Pearson and Michael Coen were valuable in that they added to our knowledge about important topics in jewelry manufacture. Thus,

they will be invited to be part of our course when it is taught again. Students very positively respond to guest lecturers, so we intend to recruit additional ones when possible.

The students completed all of the laboratory assignments and submitted their results for grading.

Class 15 – May 11, 2016

The lecture was about the Theory of Plate Tectonics, which was a powerpoint presentation complemented by handouts about paleomagnetism. The class ended by each student doing an assessment of the course using the SALG (Student Assessment of Learning Gains) guidelines and philosophy. The SALG has 22 questions that require a written answer. The anomalous responses were delivered by a student to the Jewelry Department for viewing by us after the final grades are determined.

Class 15 Reflections

The answers the students gave in their Student Assessment of Learning Gains (SALG)assessment are valuable for when we teach the course again and are an excellent way to gauge the effectiveness of our teaching method and the appropriateness of the course material and relevance of the laboratory experiments.

Science of Jewelry – Student Assessment, Spring 2016

Joseph Liddicoat, Science and Mathematics Department
Steven Parker, Jewelry Department

1. How much did the following aspects of the course help you in your learning?

   Describe your experience with the instructional approach taken in the course.
   Did class topics, activities, reading, and assignments complement one another?
   What suggestions would you make regarding the pace of the course?

In what ways did the support you received from others helped in your learning?
How has this course changed the way you learn/study?

2. As a result of your work in this course, describe the gains made in your understanding of each of the following:

   The genesis of ore deposits.
   The environmental impact of mining ore and gem quality material (gold, silver, diamonds).
   Tectonic processes that result in concentrations of ore and minerals.
   The physics and chemistry of combustion and thermodynamics.

3. How did the following lab exercises contribute to your personal skill set?

   Using gemological analysis tools.
   Safely using torches and gas burners.
   Safely using acids and other chemicals required in analysis and assay of metals.
   Generating reports consistent with laboratory procedures.

4. Comment on how this class has changed your attitude about the relationship between science and jewelry.

   The subject of jewelry manufacture.
   The environmental consequences of jewelry manufacture.
   The processes involved in jewelry manufacture.

5 Evaluate how these various components of the course impacted your receiving information helping you achieve the proposed learning outcomes:

   Course lectures.
   Laboratory exercises and discussions.
   Field trip to the Hall of Meteorites and Minerals and Gems at the American Museum of Natural History.
   The input of guest lecturers (Michael Coan, Gary Roskin, Karen Pearson).