An Online Social Networking Approach to Reinforce Learning of Rocks and Minerals

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ABSTRACT

Numerous and varied methods are used in introductory Earth science and geology classes to help students learn about rocks and minerals, such as classroom lectures, laboratory specimen identification, and field trips. This paper reports on a method using online social networking. The choice of this forum was based on two criteria. First, many traditional students are likely comfortable with such an interface and its associated learning style. Second, social networking sites have functionality, such as the ability for users to link and group themselves, which is not available in other common web-facilitated learning environments such as course management systems. Each student was assigned the role of a unique mineral and rock. They were required to create a separate web page for each, with a photograph and description, on MySpace.com, a popular social networking web site. They were also required to join groups based on the classification of the rock or mineral. Finally, they were required to link to the minerals that constitute each rock by becoming "friends." A post-exercise questionnaire showed all students found this a useful and enjoyable exercise, and most believed it helped them to learn and remember information about rocks and minerals.

INTRODUCTION

The nature and extent of online education is a rapidly evolving subject. In a recent study, Allen et al. (2007) categorized courses into four types based on the proportion of content delivered online. The types and associated percentages of online material are 1) traditional or face-to-face (0%), 2) web-facilitated (1% - 29%), 3) blended/ hybrid (30% - 79%), and 4) online (80+%).

Allen et al.'s 2007 report cites a 2006 survey conducted by Eduventures of 2,033 potential students in the United States interested in pursuing postsecondary education in the next three years. Participants were queried regarding their preferred mode of delivery. The most frequent type chosen was web-facilitated (24%), edging out traditional (22%) and online (20%).

Although posting one's syllabus online would likely vault an instructor over the low 1% hurdle to make his/her class web-facilitated, a more important question raised but not answered by this survey or report is what sort of web enhancements these students are expecting or craving. An instructor could provide content online in numerous manners that could be broadly classified into three categories. The first of these categories would be online course management systems (CMS), internet applications, or web pages built or customized specifically for the instructor's class. Course management systems such as Blackboard, WebCT, ANGEL and Moodle are designed to offer all sorts of instructor- or student-generated online content, including lectures, assessments, and discussions.

The second category would be third-party internet applications or web pages that are closely aligned with the content of the course. Using such sites, students can review or build upon various components of the class. Third-party sites might be designed by individuals, private industry (e.g., textbook publishers), government agencies (e.g., U.S. Geological Survey http://education.usgs.gov/) or academic institutions (e.g., The Massachusetts Institute of Technology's OpenCourseWare courses in Earth, Atmospheric, and Planetary Sciences, where all course content is available online http://ocw.mit.edu/OcwWeb/Earth--Atmospheric--and-Planetary-Sciences/index.htm).

The third category would be third-party internet applications or web pages that are not closely aligned with course content. An example of this would be e-mail. The popularity of e-mail with students could be attributed to a number of reasons, such as most students have experience using it, and they generally find it useful and enjoyable. Other internet applications and representative web sites that share similar widespread popularity include internet search engines (e.g., Google http://www.google.com), open content information sources (e.g., Wikipedia http://www.wikipedia.org), e-commerce (e.g.,

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Amazon http://www.amazon.com or EBay http://www/ebay.com), mapping services (e.g., Mapquest http://www.mapquest.com), and photo, audio and video sharing (e.g., photo sharing at Flickr (http://www.flickr.com, podcasts at iTunes http://www.apple.com/itunes/ or video clips at YouTube http://www.youtube.com/).

All three categories offer distinct advantages and disadvantages to the instructor. The first category is customized to the instructor and his/her class, but may require a fair amount of effort to implement. The second category uses available resources, but may not align precisely with class content or learning objectives, may require extensive searching and organizing by the instructor, and may not be there the next semester an instructor wants to use them. Also, sites devoted to scientific content in both of these categories run the risk of eventually eliciting feelings associated with the drudgery of homework to some less motivated or engaged students. The third category may mitigate this risk to some extent. Students may be more willing to visit or spend time on sites with preexisting, positive associations. The challenge to the instructor is customizing content so that it is useful in achieving learning objectives within such an online environment.

In this paper, I present an example of an exercise used to reinforce learning about rocks and minerals in an introductory undergraduate Earth science class using MySpace (http://www.myspace.com), a popular social networking website. One reason for putting the exercise on MySpace was the anticipated benefits of a popular web site discussed above. The other reason is that social networking web sites such as MySpace have tools for creating classifications and connections that would be difficult to replicate in a course management system or on a personal web page.

In the following sections, I will discuss the specifics of the assignment, including online social networking functionality, requirements, and assessment. I will then discuss a post-exercise student questionnaire, and what responses indicate about how technically difficult, useful and enjoyable the assignment was. I will discuss personal observations of the experience, its merits as an active, collaborative, experiential learning experience, and potential applications to other classes.

METHODS

MySpace is a social networking web site. Using such sites, individuals can build and interact with family, friends, people with common interests, or strangers. Much of the functionality offered at MySpace is similar or identical to tools found within most CMS, such as e-mailing, chatting, discussing and file sharing.

MySpace also includes tools not found in CMS which are specifically designed for the purpose of building social networks. One of these functions is the ability to make friends. Friends are the nodes in the social network, and the friendship is a one-to-one connection among the nodes. Any member can ask another to be a friend, and that person has the option of accepting or rejecting the initiator as a friend. Friends generally share more openly with other friends; for example, a friend is often able to see a friend's other friends.

Another function is the ability to create and join groups. Users in a group share a group web page, message board, and – presumably – at least some commonalities. In a sense, members that join groups are practicing a form of self-classification. By joining a group of say, dog lovers, they are likely identifying themselves as such. Some CMS do allow the creation of groups, which is an obvious need if group projects are a component of the class. In some CMS, however, groups cannot be created by students.

This educational experiment was designed using MySpace for a summer session of an introductory Earth science class (lecture and laboratory) in 2007. The class consisted of 16 students, 15 of which were of traditional college age. The ratio of male to female was 6:10. The class contained content typical of a physical geology/Earth science curriculum.

The MySpace exercise was meant to reinforce learning about minerals and rocks. These topics were also covered with numerous other methods typical of such an introductory course, including the textbook, classroom lecture and discussion, laboratory manual and exercises, online quizzes and discussion, exam questions, and a campus survey of building stones. The topics of minerals and rocks are covered during approximately the first week of the five week summer term.

The assignment required students to join MySpace under the guise of a specific rock and mineral. Each student was assigned to one and only one of each. Fulfilling requirements involved three basic steps. The first step was to **create two MySpace web pages, one each for the assigned**

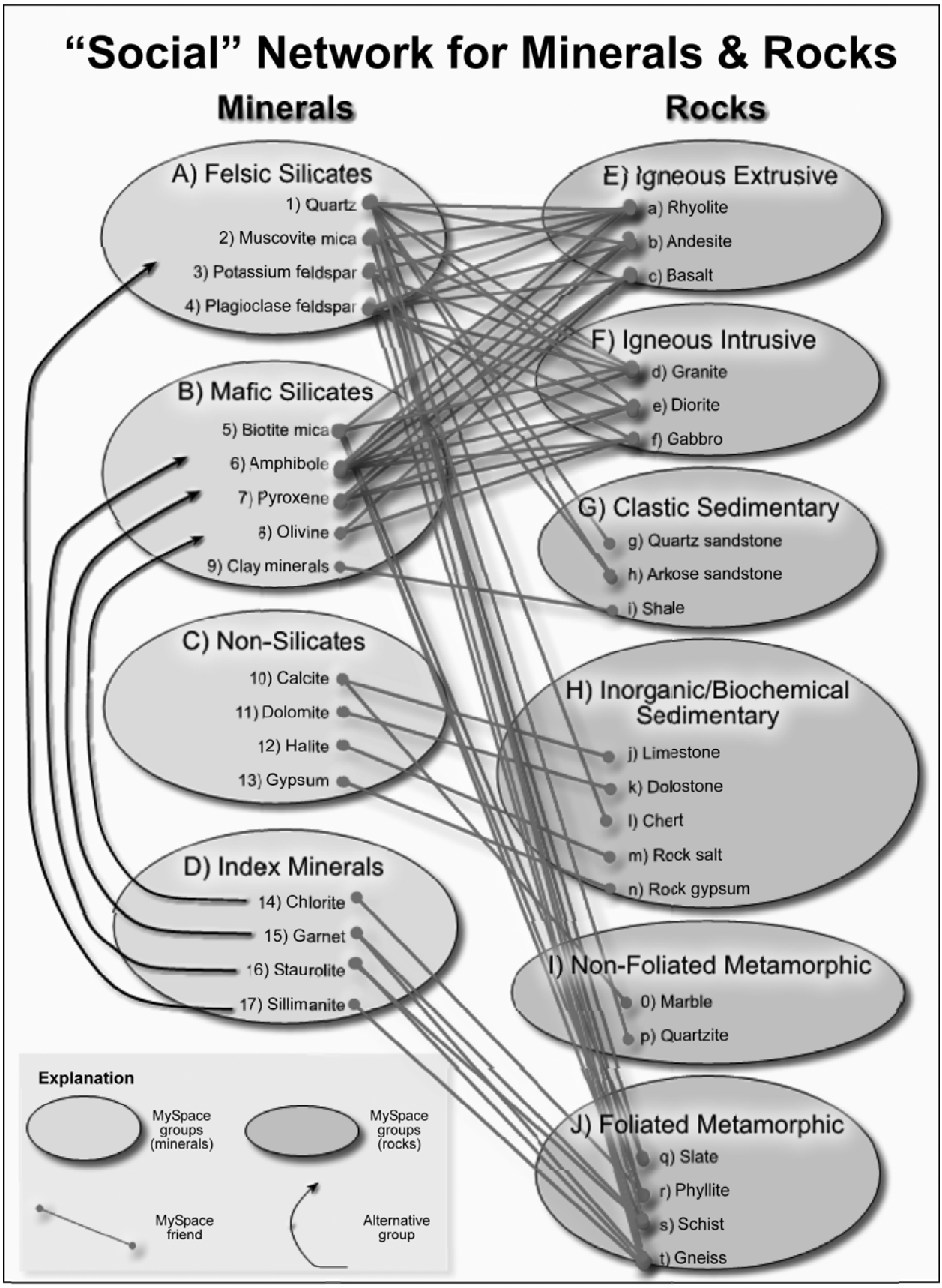

Figure 1. The solution used for a network of minerals and rocks classified into groups and connected as friends in MySpace..

mineral and rock. Each page was required to include a description and picture of the rock or mineral in its profile.

The second step was to join groups corresponding to classification systems discussed in the classroom and textbook for minerals and rocks. Minerals and rocks were classified into four and six groups, respectively. A copy of the assignment distributed to students is included as Appendix A. Groups are listed in the "Requirements" section.

The third step was for minerals to make friends with the rocks which might contain them, and for rocks to make friends with the minerals of which they may be comprised. In order for students to easily find fellow students, I created a class group that everyone was required to join. Additional details are included in the 'Requirements" section of Appendix A.

This educational experiment was designed to assess student performance using a detailed rubric. The assignment was comprised of 100 possible points. Specific requirements were assigned point scores of 5 or 15. Requirements worth 5 points generally required performing an action only once, such as joining the class group. Requirements worth 15 points often involved multiple actions (such as making multiple friends), or writing content for the profile. The rubric is included in the "Grading" section of Appendix A..

This learning exercise had students show their MySpace pages in class on the due date for the following reasons. First, the size of the class permitted this option. Second, students seemed genuinely happy with the project and anxious to showcase their pages. Third, I as instructor could find all of my students' MySpace pages from the class group, see their profiles, and see who their friends were, but I was unable to see which groups they joined. This would have required me to make MySpace friends with all of my students and requiring them to correctly set controls to allow me to see their groups. I made a conscious decision not to take this approach in the hopes of keeping myself removed from the online dynamics of what I hoped would become a collaborative, self-organizing social network. Presentations occurred during the middle of the fourth week of class, well after this material and its assessment in lecture and lab had finished.

RESULTS

The network of rocks and minerals used as a solution is shown in Figure 1. Although much discussion is possible over the details, connections and groupings are based on summary figures and discussion from the textbook used for this class (Lutgens and Tarbuck, 2003). Grades ranged from 85 to 100, with an average score of 95. The most common reason for losing points included incorrect content in MySpace profile descriptions, and making the wrong friends (making friends with real-life friends seemed an almost irresistible temptation to some).

An anonymous student questionnaire gauged the level of effort required of this exercise, as well as students' impressions of how useful and enjoyable the exercise was. Five questions used a five level Likert scale, one question asked for a time estimate within intervals provided, and two questions asked for a yes or no response. Students were also asked for comments on the assignment. All 16 students participated in the survey, and results were not viewed until after final grades were submitted. I include results as Appendix B, with number of students responding in each class highlighted in bold.

Important findings are that all students agreed this assignment was useful and enjoyable, and most found it very much so. No students disagreed with the statement that they learned or remembered much about rocks and minerals by doing this assignment, although agreement here is not as strong as in the previous questions. A majority of students disagreed that the technical requirements of this assignment were difficult, although two agreed. Most students spent less than four hours completing the assignment, and only one spent over eight hours. 75% of the class had previously visited a social networking site, and nearly 70% had previously created a webpage on such a site.

DISCUSSION

The intent of this exercise was to have students participate in an active and collaborative learning experience. Students unanimously found the exercise useful and enjoyable, and most felt they learned and remembered more about rocks and minerals. The only potentially negative feedback from the survey was that two students agreed with the statement that the technical requirements were difficult. This seemed unusual upon examining the two specific questionnaires with this response, as both indicated that they had previously visited and created web pages on such sites. One possible explanation is that this statement is the only one in which disagreement would be viewed as a positive factor of the

exercise. Students may simply have assumed the left-most column was always the best answer.

I observed high levels of student activity and collaboration both online and in the classroom to complete this assignment. Activity learning strategies as utilized here have been found to be useful to introductory geology students (McConnell et al., 2003). Such activity can occur in the classroom (e.g. Reynolds and Peacock, 1998) or online (Prothero, 2000). Data from active learning studies also tie student interaction through collaborative learning to performance (e.g. Bykerk-Kauffman, 1995).

Student collaboration online was essential to earning all potential points for the exercise. Asking someone to be a friend was not enough; only if a classmate accepted another as a friend is the connection created. Also, one and only one person in each potential group needed to make the group, preferably with the name suggested in Appendix A, so that other members could find and join the group. Although I heard anecdotes of technical issues of creating groups (new users must wait a week before creating a group and one 17-year-old student was unable to create a group due to her age), students took it upon themselves to work cooperatively, help each other, and organize themselves.

One unplanned result of this educational experiment was that two female students familiar with MySpace took leadership roles. They offered technical help to students unfamiliar with the website, often borrowing my laptop during break times. This was especially refreshing given my observations while teaching other introductory Earth science class, where the active learning experiences such as laboratories and field trips are more likely to be dominated by male students.

Another unforeseen benefit of this exercise was the breaching of social barriers in the classroom. The classroom is generally an extremely social locale, especially before and after class, and during breaks. Generally, however, social interaction occurs only in small cliques, often comprised of students who know each other before taking the class. In this milieu, however, students often interacted outside of their well-established social circles in the classroom.

I also found the focus of students on the lecture content associated with minerals and rocks much stronger than usual. Students obviously asked questions associated with information they would need to complete the assignment. In addition, they made inquiries that indicated they were looking to bond with their rocks and minerals, such as asking where a certain rock is likely to be found, or if minerals have nicknames.

Active learning, whether online or in the classroom, requires students to do something, an important component of Kolb's experiential learning theory (Kolb and Fry, 1975; Kolb, 1984). Experiential learning focuses on the process involved in a learning cycle. This cycle is comprised of reflective observation, abstract conceptualization, active experimentation, and concrete experience. These components are also referred to by the shorthand of Observe, Think, Plan and Do, respectively (Jenkins, 1988). Experiential learning methods have been explored in a number of related fields, including engineering (Stice, 1987), geography (Healey and Jenkins, 2000), soil science (Mellor, 1991) and wildlife studies (Millenbah and Millspaugh, 2003). An approach similar to this MySpace exercise would be providing substitute experiences (Gibbs, 1988), which might involve games, simulations, or role playing.

Achieving learning objectives may take students through a series of cycles, creating a virtual spiral of learning experiences, each reinforcing the previous (Healey and Jenkins, 2000). The advantage of such an approach is that the instructor can design the class to appeal to a number of different learning styles. Tailoring exercises to different learning styles recognizes and can help to validate the diversity of ways in which students learn. Based on four learning styles in the Learning Style Index (Kolb, 1984; Smith and Kolb, 1986), this MySpace exercise would be most closely aligned with an "Accommodator", one who can carry out plans, is interested in action and results, and adapts to immediate circumstances.

The MySpace exercise in this class was designed to add an additional cycle to an already well established spiral of classroom and online activities designed to reinforce learning about rocks and minerals. It was the only rock and mineral activity, however, to extend temporally beyond the lecture and laboratory exams covering these topics. This served to review these topics longer into the term, and reinforced basic concepts that are important throughout the class.

This MySpace example is an exercise in classification and composition. Similar network building exercises, however, could be designed for other geologic topics or classes. This is not to say, however, that designing such an exercise is without challenges. One of the greatest challenges in this exercise was balancing the same number of

minerals as the rocks they compose. This carefully structured pretext may well experience trouble if students later drop or add the class. Also, for any non-trivial network solution (Figure 1), individual students will be required to make different numbers of friends. In this exercise, the number of friends varied from nine to one for different rocks and minerals. The exercise was designed to balance this by giving students with socially popular minerals socially unpopular rocks, but still the total number of friends varied from ten to four. No students, however, complained about this inequality in the class or on the questionnaires. In my opinion, students would have been willing and enthused if more online interaction was required.

CONCLUSIONS

There is a perceived need or expectation among potential students for online content. The initial reaction of the client-centric instructor may be to take existing classroom material such as Microsoft PowerPoint presentations and post them to the class' course management system. This may be useful, but such content was likely designed for the face-to-face classroom. There may additionally be other worthwhile opportunities to enrich and enhance the learning experience by creating or using other applications designed specifically for the online environment.

Many excellent online applications have been created to achieve learning objectives specific to Earth sciences. Much more prevalent and widely visited, however, are sites that have specific functionality related to the manner in which many people enjoy spending time online. Social networking sites, such as MySpace.com, are one example of such functionality, where individuals can make online connections with others.

Using MySpace, I designed and implemented an educational exercise to reinforce learning about minerals and rocks in an introductory Earth science class. Each student was assigned to a rock and a mineral. Requirements including describing the mineral or rock, joining groups based on classifications, and making friends based on composition. Students collaborated closely online and in the classroom to complete the exercise, and assessment scores were high. Student questionnaires indicate students found the exercise useful and enjoyable, and most felt they learned and remembered much about rocks and minerals from the exercise. This MySpace exercise could be modified for use in any class that involves entities that are connected or classified. Beyond MySpace, much potential exists for engaging students in the cyberspace which they are already very comfortable inhabiting.

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APPENDIX A. MySpace Exercise with Rubrics

-MySpace.com Exercise-
Building Social Networks with Minerals and Rocks

Overview

This is an online exercise to reinforce what we will be learning in class about minerals and rocks. You will be doing this exercise at MySpace.com, a social networking website. You will be required to have two different entities on MySpace, one for a rock and one for a mineral. As MySpace requires an e-mail address to get a web page, you will need two e-mail addresses not currently being used for a MySpace web page.

Requirements

The assignment will consist of three parts:

1) *Create separate MySpace web pages for your mineral and your rock.* I will assign a mineral and a rock to you. You must create a separate MySpace web page for your rock and mineral. Each web page must have at least one picture of your rock or mineral. You must also write an accompanying description in the "About me" portion of your MySpace profiles that correctly describes your rock and mineral.
2) *Put your MySpace web pages into their proper groups.* So that I can easily find everyone in the class, all rocks and minerals are required to join the group "CWPostERS2RocksAndMins" which is already created in MySpace. As we discuss minerals and rocks in class, you will see that we group similar ones together. Each of your rocks and minerals will fall into one of these groups. These groups are not yet created. You should search for your group, and if you find it, join it. If you can't find your group, you should create it and join it. To make searching for groups easier, I recommend the following "Group Names":

   For minerals
   CWPostERS2FelsicSilicates
   CWPostERS2MaficSilicates
   CWPostERS2NonSilicates
   CWPostERS2IndexMinerals

   For rocks
   CWPostERS2IgneousExtrusives
   CWPostERS2IgneousIntrusives
   CWPostERS2ClasticSedimentary
   CWPostERS2Inorganic/BiochemicalSedimentary
   CWPostERS2NonFoliatedMetamorphic
   CWPostERS2FoliatedMetamorphic

We will discuss these groupings or classifications extensively in class, so listen for your rock and mineral! If you need more information, check our textbook.

3) *Make the right friends.* All rocks are comprised of one or more minerals, and all minerals are included in rocks. Your task will be to make friends with all of the minerals you may contain if you are a rock, or all of the rocks you may be part of if you are a mineral. Friendship is a two way street. If you're a rock, you can ask a mineral to be your friend, or a mineral may ask you to be its friend. If you are asked, be careful how you choose your friends! Not only do you have to be friends with all of the minerals that comprise you, but you can't be friends with any of the minerals that aren't found in you. Also, rocks like to join groups with other rocks and minerals with other minerals, but these groups are just made up of associates, NOT FRIENDS. Rocks should never be friends with other rocks, and minerals should never be friends with other minerals!

We will discuss what minerals occur in which rocks extensively in class, so pay attention to who your real friends are! Again, if you need more information, check our textbook.

Grading

Task	Points
1) Create separate MySpace web page &	
MySpace mineral home page shows at least	5
MySpace mineral profile ("About me:")	15
MySpace rock home page shows at least one picture of your rock	5
MySpace rock profile ("About me:") includes complete and accurate description of your	15
2) Put your MySpace web page into groups	
Your mineral and rock pages must be added to group for the entire class (The name of the	5
Your mineral is in its proper mineral group	5
Your rock is in its proper rock group (*You may have to create the group if you are first; refer to the rock group names on the previous page.*)	5
3) Make the right friends	
Friends with all of the rocks that include your mineral	15
Friends with all of the minerals that comprise your rock	15
NOT friends with any rocks that don't include you as a mineral	5
NOT friends with any minerals that don't comprise your rock	5
NOT friends with any other rocks if you're a rock, or minerals if you're a mineral	5
TOTAL:	**100**

APPENDIX B. MySpace Student Questionnaire

Student Survey
MySpace Networking Exercise

Please check the box for each statement that most closely reflects your experience with the MySpace exercise used in this class for rocks and minerals.

Statement	*Strongly agree*	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
1) I found this exercise a **useful** way to learn about rocks and minerals.	**11**	**5**			
2) I found this exercise an **enjoyable** way to learn about rocks and minerals.	**12**	**4**			
3) I feel that I **learned** much about rocks and minerals by doing this assignment.	**9**	**4**	**3**		
4) I feel I **remember** much about rocks and minerals after completing this assignment.	**9**	**5**	**2**		
5) I found the **technical requirements** of this assignment (creating content in Myspace) to be difficult.	**1**	**1**	**4**	**5**	**5**
HOURS	*0-4*	*4-8*	*8-12*	*12-16*	*> 16*
6) I spent approximately the following number of hours working on this assignment.	**9**	**6**	**1**		
	Yes	*No*			
7) I visited MySpace or other online social networking websites before beginning this class.	**12**	**4**			
8) I created a personal webpage on MySpace or another online social networking website before beginning this class.	**11**	**5**			

Comments:

- Great assignment: enjoyable and useful.
- This was a great project to do because it wasn't the same old "posterboard" or term paper.
- Good project.
- I thought this was a great way to learn about rocks and minerals. It was a lot of fun and it was a way to learn through something I am comfortable with. It was something new and different!
- Excellent assignment to interest students!
- Really can't do this exercise if one student fails to do it because it will interact with someone' else page in a negative manner. (Being friends with someone else)
- It was a fun project. I strongly recommend future use.
- Very useful to learn about rocks and minerals but all rocks and minerals should have to be up sooner so that there is not a mad scramble the night before to make sure you have all your friends.
- I like George Michael.
- B/C I never made a MySpace before it was difficult to figure some stuff out and it made it kind of frustrating but overall it was no big deal. It was creative.
- Very interesting class! Professor was very helpful and great personality. I learned a lot in this class and from the professor. The MySpace was fun and creative