

Students' Perceived Areas for Improvement in an Online Learning Environment

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Abstract

For a variety of reasons, students are enrolling in online courses in increasing numbers. Students often approach online courses with the perception that since they are convenient and flexible, and computer based, they should be easier than the same course taught in a traditional face-to-face classroom. However, as these students quickly discover, the online course is often more difficult than what they expected. The nature of an online course, where students are typically working asynchronously at home with material delivered via computer, is very different from that of a traditional face-to-face course. Oftentimes, the skills that students have developed to succeed in the traditional face-to-face classroom may not be sufficient for success in the online environment. While scholarly research has been conducted regarding the importance of online learning skills from an institutional or instructor's perspective, little has been revealed from the students' perspective. This research involves examining the learning skills necessary to succeed in an online environment from a student's perspective obtained through student self-assessment. The information provided by these self-assessments will enable faculty to better focus on the issues and concerns of students learning throughout a course in an online environment.

Background

Intuitively, it is understood that face-to-face courses and online courses differ considerably due to the lack of personal contact. The nature of the online environment prevents verbal and non-verbal communication cues between students and teachers and instead relies almost entirely on written communication. This absence of classroom affect creates a unique learning environment for students and teachers; students must take more responsibility for their own learning process and managing their own affect (Kauffman, 2004). The instructors are no longer the “sage on the stage” but instead must alter their pedagogy to create a more learner-centered learning environment (Siedlaczek, 2004; Howland & Moore, 2002; Smith and Apple, 2007). While student self-assessment is useful in the face-to-face classroom, this tool can help overcome the lack of communication cues and be exceptionally beneficial in the online learning environment.

Self-Assessment is one type of formative assessment used by faculty that asks students to reflect on the quality of their thinking and identify strategies to improve their skills and understanding (McMillian and Hearn, 2008; Wasserman and Beyerlein, 2007). Weimer (2002) more specifically states the process requires students to “identify relative strengths and weaknesses, determine what next needs to be improved, develop an improvement plan, implement it, and finally use an assessment of its effectiveness to position themselves for the next round of improvement”

(p. 131). Engagement in this process develops the skills critical for students to become more self-directed learners (Andrade & Valtcheva, 2009; Shepard, 2000) and become lifelong learners (Zimmerman, 2002; Schunk, 2003; Chappuis & Stiggins, 2002; Nancarrow, 2007). Ample research has demonstrated a wide range of benefits from the use of self-assessment in the classroom. Black and Wiliam (1998) concluded that students demonstrated improved motivation and Yusuff (2014) found significant improvement in academic achievement. Boud argued that self-assessments created increased opportunities for deeper learning (Boud et al., 1987).

In the literature, the term self-assessment appears to often be used interchangeably with self-reflection and self-evaluation. While all three terms involve students' self-reporting, there is a clear distinction between the three techniques (Andrade & Du, 2007; Dejarlais & Smith, 2011). Self-reflection requires students to consider their attitudes, achievement or interests without comparison to an established set of criteria. Self-evaluation involves making summative conclusions and determining a final grade. Self-Assessment occurs when the students reflect on their work and learning and use criteria to evaluate their strengths and weaknesses while developing corrective strategies to improve performance (Andrade & Du, 2007; Wasserman & Beyerlein, 2007).

In online courses, the use of self-reporting formative assessment provides results similar to face-to-face courses.

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Gikandi, Morrow, and Davis (2011) reviewed eighteen studies to determine how formative assessment supports learners in an online environment. They concluded self-reflection provided opportunities for increased engagement and active learning. A US Department of Education meta-analysis (2010) recommended the incorporation of mechanisms that provide for student self-reflection and determined that online courses which included self-reflection provided advantages over online courses that did not provide this opportunity.

Oftentimes, self-assessment is utilized to help grow students' learning skills. Bloom et al. (1956) created a classification of learning skills to assist educators to better understand the skills involved in the learning process and to advance student knowledge. Bloom included three domains: cognitive (knowledge), affective (attitudes) and skills (psychomotor). The learning skills included within each domain were arranged from lower order thinking skills to higher order skills. For decades, this framework has been widely used by educators for lesson planning, curriculum development, and to promote deep learning. Others have revised or augmented this taxonomy (Anderson, Krathwohl, et al., 2001; Biggs & Collis, 1982; Fink, 2003; Bobrowski, 2007).

After reviewing the writings on the relationship between cognition and affect by Allender (1983) and Krathwohl (1964) as well as Bloom's (1956) description of school related affect, subject related affect and academic self-concept, Martin and Briggs (1986) concluded the cognitive and affective "domains interact significantly in instruction and learning" (p. 95). Meyer (2007) asserts even if the primary goal may be on cognitive outcomes, affective learning is an integral component of the process. Despite this interconnection, until recently, research focused primarily on the impact of each domain on learning as a separate entity. Since teachers focus on the mastery of content and cognitive outcomes are generally easier to measure and control, the research of the role of cognition in learning and teaching has overshadowed research on the role of affect (Picard, et al., 2004). Additionally, affective outcomes are less predictable and more difficult to quantify. Pierre (2007) postulates several reasons for this: an emotion can be difficult to measure; the same emotion can vary in intensity from one individual to another; and cultural, religious or moral belief systems influence emotion. Often educators assume if they focus on cognitive skills, students would then learn the necessary affective skills on their own. However, Krathwohl et al. refute this claim: "The evidence suggests that affective behaviors develop when appropriate learning experiences are provided for students much the same as cognitive behaviors develop from appropriate learning experiences" (1964, p 20).

These learning skills, however, are not static. Instead, the skills can be identified, practiced and improved over time, regardless of a person's age or experience, "through self-reflection, self-assessment, and/or guidance by a mentor" (Apple, et al., 2007, p. 201). The current research seeks to examine the relationship between the affective and cognitive domains in students learning in an online environment. More specifically, the students self-reported cognitive and/or affective skills that they view as areas for improvement through the process of self-assessment.

Methods

Every instructor's goal is to help their students become better self-directed learners. Improving student performance with particular learning skills would not only help to improve the student's performance in the current course, but will also likely transfer to improvement in future courses. To help students with analyzing these learning skills the use of self-assessments was incorporated as a learning tool in each of the three courses within the study. By implementing these self-assessments in each of our on-line courses, we were able to collect and analyze the learning skills that students feel enable them to succeed in an online course and the skills they feel that they need to improve.

Before students can conduct a self-assessment, they must understand what assessment is as well as have an understanding about the skills required for learning. To this end, on the first day of the online course, students complete an activity which has them explore a classification of learning skills from the affective and cognitive domains, as well as examine the role of self-assessments. To prepare for the activity, the students read an excerpt from the chapter, "Self-Assessment the Engine of Self-Growth" in *Learning to Learn: Becoming a Self-Grower*. Additionally, they read modules on the classification of learning skills, the affective domain and cognitive domain. Then, within the critical thinking questions, the students examine their perceived skill level. Specifically, the students identify two skills from each domain they feel are their strengths leading to successful learning as they begin the course. They also choose two skills within each domain they believe that they need to improve to succeed in an online course. This introductory activity, presented in Appendix 1, orients the students and prepares them to conduct their own self-assessment throughout the remainder of the course.

For the remainder of the five-week course, at the end of each chapter or module, students conduct a self-assessment using a self-assessment tool that guides the students in performing an SII (Wasserman & Beyerlein, 2007). This tool requires students to self-report the two skills that they perceived as their strengths, as well as why they perceived these skills as their strength while working through the

chapter or module. Reporting why or how these skills were strengths allows the students to repeat the performance. The students also self-reported the two skills that they perceived needed improvement based on their performance during the chapter or module. They were then required to write an action plan for the skills improvement in the short term (next chapter or module) as well as the long term (remainder of course and future courses). The instructors reviewed these assessments and provided feedback to the students after each submission. This feedback would help reaffirm the strengths indicated as well as providing guidance and suggestions on the implementation of their stated action plan.

At the end of the course, each of the students had completed 6 to 8 self-assessments depending on the course in which they were enrolled. These assessments were used to create a panel data set that indicated the cognitive and/or affective skills the students perceive they need to improve so that they can succeed in their online course. We excerpted the skills indicated as areas for improvement for each student for each chapter or module depending on the course. Some students identified the skill directly. For example, one student indicated the skill which is validated by the proposed action plan:

“Managing resources – applying assets and means to important goals. For Chapter 8, I fell a little behind because I did not manage my time efficiently. To improve this skill, I will break down the work for Chapter 9 (i.e., read the text, read the notes, complete the pre-test, complete the study plan, complete the homework, complete the self-assessment) and set mini goals and deadlines for completing each element. I feel that this should be less overwhelming than setting a single goal for completing the entire chapter by its official deadline.”

Other students did not explicitly list a learning skill but the authors inferred the skill from the context of the proposed action plan. For example, the following action plan was categorized as Managing Resources:

“For Chapters 8 and 9, I need to be able to decide how much time to spend on PowerPoints and flashcards (maximum has been a day and a half) and how much time I need to accomplish Apla, assignments, and discussions.”

After determining the learning skills identified by the students, the authors mapped each skill to a skill cluster and processes within the affective domain (Duncan-Hewitt, Leise & Hall, 2007) or cognitive domain (Davis et al., 2007).

Results

Through the use of this data set we were able to analyze which skill clusters in the cognitive and affective domains students consistently perceive as areas in which they need to improve. We examine the balance between affective and cognitive skills

identified by the students in all courses as well as present the distribution of skills perceived as an area for improvement as one of the courses progresses as a case study.

Aggregated Results

We aggregated the skills reported in the student responses from all three courses. We classified each reported skill into its domain, process, and cluster. As indicated previously, the classification of the learning skills the students listed are aggregated in the following manner:

SKILL → CLUSTER → PROCESS → DOMAIN

In what follows, the aggregated results are analyzed beginning with the DOMAIN level and are then disaggregated back down from the PROCESS to the CLUSTER and SKILL levels.

In the aggregate, throughout all three courses, 56 percent of the skills students sought to improve were in the affective domain, while 44 percent of the skills students sought to improve were in the cognitive domain as depicted in Table 1. When looking at the Processes within the affective and cognitive domains, skills listed as areas for improvement in the *Organizing (Managing Oneself)* in the affective domain were listed by more than half (52 percent) of the students. The *Processing Information* process was the next most common process listed by students (23 percent) followed by *Constructing Understanding* (12 percent). To further explore what skill clusters and skills students feel that they need to improve to succeed within the course, we examine each of the domains separately.

Table 1 Percent of Responses for Process Across Both Domains

Process	Areas For Improvement
Affective Domain	56%
Organizing (Managing Oneself)	52%
Responding (Engaging in Life)	3%
Receiving (Being Open to Experience)	0.4%
Internalizing	0%
Valuing/Cultivating Values	0%
Cognitive Domain	44%
Processing information	23%
Constructing Understanding	12%
Applying Knowledge	7%
Solving Problems	2%
Conducting Research	0%

Affective Domain

Within the Affective Domain, two processes were indicated by students *Organizing (Managing Oneself)* (52 percent of skills listed) and *Responding (Engaging in Life)* (3 percent of skills listed). Breaking down each of these PROCESSES further reveals the skill CLUSTERS in which students reported skills that they need to improve.

As depicted in Table 2, the skills that students listed as areas for improvement fell into all skill clusters within *Organizing (Managing Oneself)*. Over half of the skills were listed in the Regulating Self cluster (55 percent), followed by Managing Performance (31 percent), lastly Managing Emotions (14 percent). All skills listed within the *Responding (Engaging in Life)* were in the Addressing Life's Changes skill cluster (100 percent).

Table 2 Affective Domain Skill CLUSTERS

CLUSTER Areas within PROCESS	Percent in PROCESS
Organizing (Managing Oneself)	
Regulating Self	55%
Managing Performance	31%
Managing Emotions	14%
Responding (Engaging in Life)	
Addressing Life's Changes	100%
Emoting	0%
Leveraging Life's Successes	0%

The distribution of the individual skills within each CLUSTER indicated by students as areas that needed improvement are depicted in Figure 1. The most variation of skills indicated within the cluster are within *Regulating Self* and *Managing Performance*. Modulating emotions was the only skill in *Managing Emotions*. Within *Addressing Life's Changes* only *Accepting Help* and *Persisting* were listed as areas for improvement.

Cognitive Domain

Within the cognitive domain, the skills CLUSTERS that contained the skills identified as areas for improvement are much more varied than was observed with the affective skills as depicted in Table 3.

Skills Across Both Domains

If we delve into the skill level in the aggregate to examine the top 10 skills indicated as areas for improvement throughout the courses, only Managing Resources is indicated by more than 10 percent of the students. Being self-disciplined is close at nearly 10 percent. Interestingly, there is a 50/50 split between affective and cognitive skills that are listed as depicted in Table 4. It is in the timing of when these skills are perceived by the students as areas for improvement that we see a clear distinction.

Case Study

To examine the timing of the student responses across the course, one of the three courses 5 week courses was examined. The students had 9 opportunities to submit a self-assessment. The first self-assessment was submitted three days into the course, Chap 3 Pt 1. As depicted in

Figure 1 Skill Breakdown for CLUSTERS listed in Affective Domain

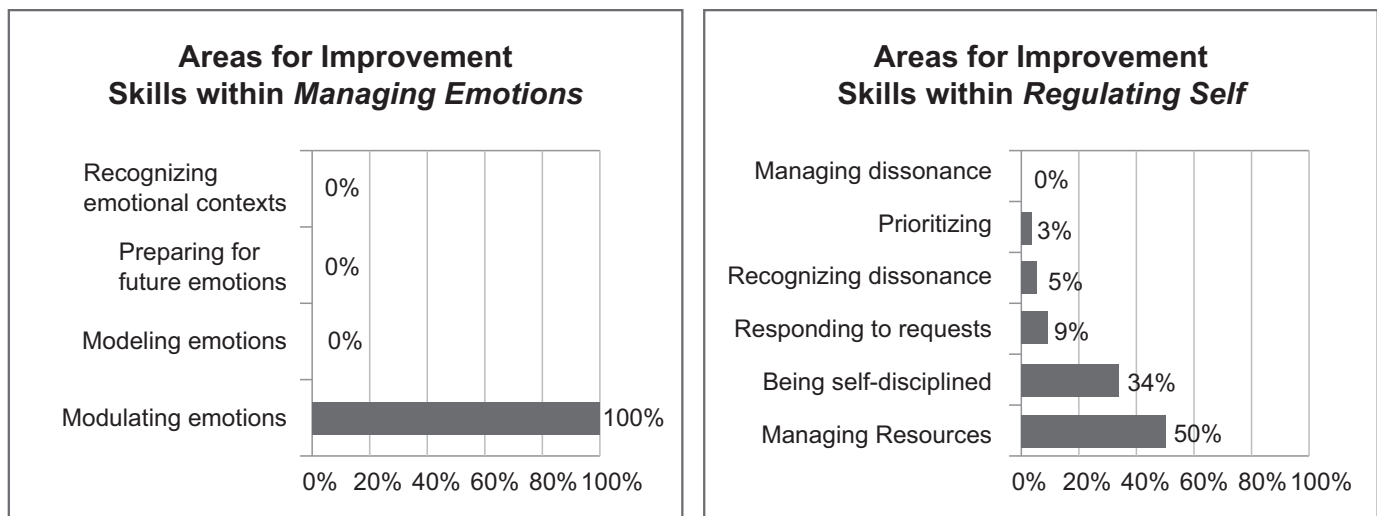


Table 3 Cognitive Domain Skill CLUSTERS

CLUSTER Areas within PROCESS	Percent in PROCESS
Processing Information	
Collecting Data	34%
Retrieving Data	33%
Organizing Data	23%
Generating Data	8%
Validating Information	2%
Constructing Understanding	
Reasoning	43%
Validating Understanding	23%
Analyzing	17%
Synthesizing	17%
Applying Knowledge	
Performing with Knowledge	60%
Modeling	25%
Being Creative	15%
Validating Results	0%
Solving Problems	
Identifying the Problem	67%
Structuring the Problem	33%
Creating Solutions	0%
Improving Solutions	0%

Table 4 Top 10 Skills Identified as Areas for Improvement

Ranking	Domain	Skill	Aggregate Percent
1	Affective	Managing Resources	14.23%
2	Affective	Being self-disciplined	9.61%
3	Affective	Modulating emotions	7.47%
4	Affective	Preparing	7.12%
5	Affective	Rehearsing	5.69%
6	Cognitive	Recording	5.34%
7	Cognitive	Recalling	4.27%
8	Cognitive	Systematizing	3.20%
9	Cognitive	Deducing	2.49%
	Cognitive	Validating completeness	2.49%
	Affective	Responding to requests	2.49%
10	Cognitive	Interpreting	2.14%
	Cognitive	Searching	2.14%
	Affective	Accepting help	2.14%

Figure 1 (continued) Skill Breakdown for CLUSTERS listed in Affective Domain

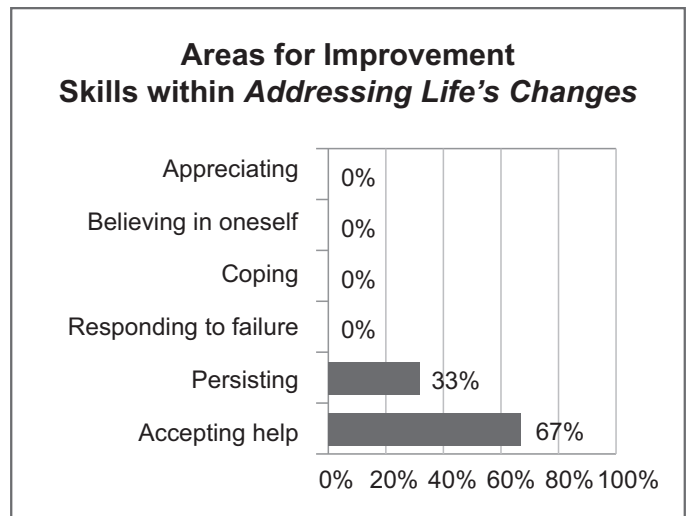
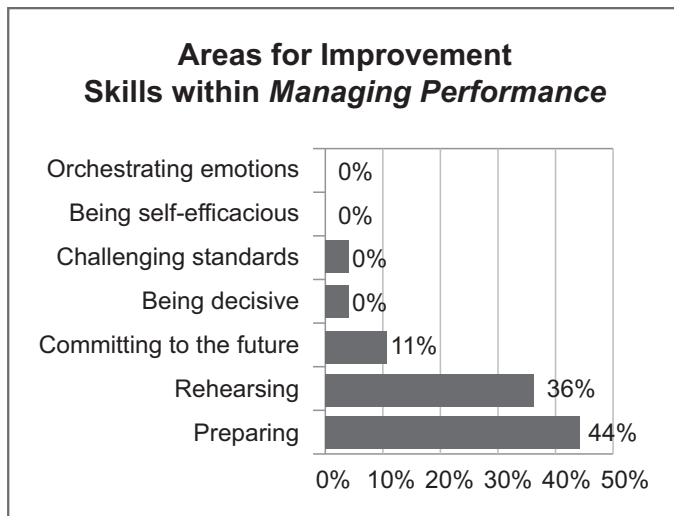


Figure 3 Distribution of skills in Affective and Cognitive Domains Across 5 Week Online Course

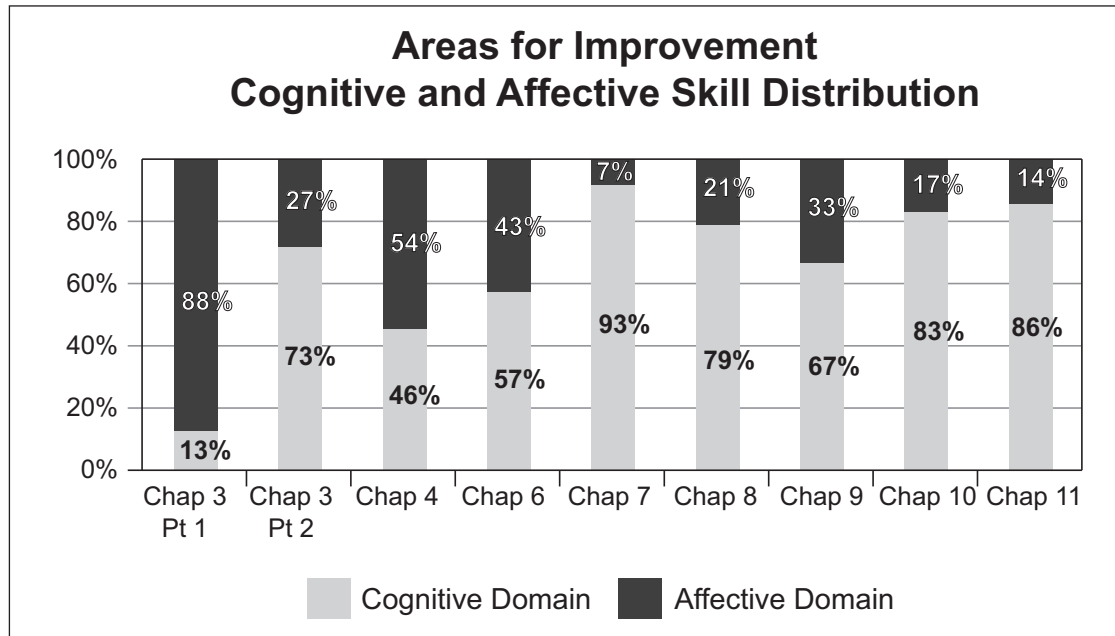


Figure 3, 88 percent of the skills indicated as areas for improvement were in the affective domain. The instructor provided feedback to the students to help implement their action plans to improve these skills. Three days later, the second assessment, Chap 3 Pt 2, was submitted. The number of students indicating the need to improve affective skills dropped dramatically to 27 percent, while 73 percent indicated the need to improve cognitive skills. Five days later the third self-assessment, Chap 4, was submitted; the skills students reported as needing improvement within the affective domain increased again to 54 percent. After Chapter 6 (approximately the end of week two) and for the remaining self-assessments, the skill area completely reverses from the first assessment and cognitive skills dominate the students' reports averaging 80 percent per assessment. Thus it appears that the students have settled into the course and were able to concentrate on primarily improving their cognitive skills.

Concluding Thoughts

After spending years in a classroom, college students are habituated to a traditional classroom since nearly all are arranged in the same manner and students readily feel comfortable in that setting. An online classroom is considerably different: there are several types of Learning Management Systems and instructors have considerable leeway in how their classroom is constructed. Students entering an online course must first adapt to the unique classroom of each professor. This unfamiliarity can cause considerable anxiety for students and make it difficult for them to adapt. In a face-to-face classroom, it is relatively

easy for the teacher to perceive the affect of the students: facial expressions are good indicators to the instructor as to whether the students are feeling negative emotions such as confusion, panic or anxiety. Once these emotions are perceived, the instructor is able to take prompt action to address these unsettling feelings and the lesson can quickly resume. In an online course, communication is predominantly written and asynchronous and does not allow for immediate feedback from students. Using self-assessments at frequent intervals allows students to express their thoughts and emotions. The comments written in response to the students by the instructor can help students overcome their anxiety early on during the online course.

The case study helps to validate this assertion. The students' perception of the affective skills needing to be improved at the beginning of the course indicates the need for the instructor to intervene on the affective side at the beginning of the online course. While content is important, students in an online course need to create their quality learning environment, learn to manage their resources and be self-disciplined; students need to manage their own affect in the online course to be successful.

Our findings highlight the benefits of incorporating student self-assessments into an online course. It appears that providing instructor feedback on self-assessments as well as the self-assessment process itself helps to mitigate students' affective issues early in the course. The feedback mechanism between the student and instructor and the information that can be gathered quickly regarding a student's progress in the course through the use of these assessments can help

a student be successful with minimal effort on the part of the instructor. In addition, the self-assessment process provides the instructor with a vehicle to create a social presence in the course. This can help mitigate the sense of isolation students often experience in online courses and improve student learning.

While we cannot state conclusively that self-assessment causes the reduction in students perceiving the need to improve

affective skills at the beginning of a course, its use clearly has an impact. The authors intend to further investigate the impact of the self-assessment process by examining the relationship of the skills reported in the self-assessments and their alignment with the discussion within the final self-growth paper of the course.

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Appendix 1: Learning Skill Activity

What is Assessment and How Will You Grow Your Learning Skills?

To succeed in any class, but particularly in an online environment, you need to understand the skills that are going to help you succeed. To help you grow these skills throughout the course, you will be completing Self Assessments of the Learning Skills that you used while learning the material in the chapter. This assignment will help you understand why we will be using self-assessment in this course, know the difference between self-assessment and evaluation, determine what affective and cognitive learning skills are and how you already implement them in your learning, as well as think about what skills you may need to improve to succeed in this online course.

PLAN

1. **Read** through the RESOURCES listed below.
2. Read and answer the CRITICAL THINKING QUESTIONS.
3. Upload this file into the assignment in BlackBoard.

RESOURCES

- Self-Assessment: The Engine of Self Growth
- Three brief articles:
 - Affective Domain
 - Cognitive Domain
 - Classification of Learning Skills
- Listing of Affective and Cognitive Skills needed for the course.

CRITICAL THINKING QUESTIONS

- What are the key differences between assessment and evaluation?
- What are the roles of self-evaluation and self-assessment when it comes to stress and performance?
- Looking at the skills listed in the **Affective Domain** → **Managing Oneself (Organizing)**
Pick 3 of the skills listed in this skill cluster and explain how each would be used in a course.
 1. Skill:
How is this skill used in a course setting?
 2. Skill:
How is this skill used in a course setting?
 3. Skill:
How is this skill used in a course setting?
- Looking at the skills listed in the **Cognitive Domain** → **Processing Data: Organizing data**
Pick 3 of the skills listed in this skill cluster and explain how each would be used in a course.
 1. Skill:
How is this skill used in a course setting?
 2. Skill:
How is this skill used in a course setting?
 3. Skill:
How is this skill used in a course setting?
- What are 2 learning skills (either affective or cognitive) that you consider your strengths and why.
 - Skill:
Why is this skill a strength?
 - Skill:
Why is this skill a strength?
- What is an action plan?
- Why are action plans important?
- What are 2 learning skills (either affective or cognitive) that you believe that you need to improve and provide one way that you will try to improve this skill at the beginning of this course.
 - Skill:
Action plan:
 - Skill:
Action plan:

Appendix 2: Learning Skills in the Affective and Cognitive Domain

AFFECTIVE DOMAIN

BEING OPEN TO EXPERIENCE (RECEIVING)

Exploring Self

- Observing self – noticing one’s actions
- Listening to self – being conscious of one’s point of view
- Perceiving reactions – seeing how other people respond to you
- Body awareness – recognizing the range of its capabilities
- Identifying emotions – sensing feelings

Exploring Surroundings

- Being curious – wanting to find out more
- Being open– welcoming, and expecting to find novelty
- Being positive – having an optimistic state of mind
- Being playful – seeking fun in experiences
- Being active – seeking activity

Experiencing Emotions

- Feeling loved – being truly valued
- Grieving – accepting loss
- Feeling joyful – feeling connected with existence
- Laughing – finding humor in experience
- Responding to aesthetics – being moved by forms of beauty
- Feeling secure – establishing a sense of security

ENGAGING IN LIFE (RESPONDING)

Emoting

- Loving – giving of oneself
- Caring – responding to others’ needs
- Respecting – demonstrating an appreciation of others
- Giving – relinquishing possessions to others
- Comforting – providing physical and verbal support

Addressing Life's Challenges

- Coping – managing stressors
- Persisting – continuing despite difficulties
- Accepting help – surmounting one’s personal limitations with help from others
- Believing in oneself – developing and maintaining self-esteem

Responding to failure – growing in response to barriers and negative results

Appreciating evaluation – recognizing value in realistic feedback

Leveraging Life's Successes

- Responding to success – investing for the future
- Being humble – allowing accomplishments to speak for themselves
- Seeking assessment – analyzing past performance to improve future performance
- Celebrating – acknowledging the meaning of accomplishments
- Acknowledging others – recognizing contributions

MANAGING ONESELF (ORGANIZING)

Regulating Self

- Responding to requests– setting boundaries to maintain personal integrity
- Recognizing dissonance– noticing inconsistencies in situations
- Managing dissonance – achieving congruence in the face of life’s inconsistencies
- Managing resources – applying assets and means to important goals
- Prioritizing – addressing what is most important
- Being self-disciplined – persisting regardless of emotions

Managing Performance

- Being decisive – choosing with confidence
- Committing to the future– engaging life goals
- Preparing – realistically envisioning the performance
- Rehearsing – improving one’s probability of success through practice
- Challenging standards – raising the expectations for one’s quality
- Being self-efficacious – synchronizing one’s abilities with one’s beliefs
- Orchestrating emotions – using feelings to aid in problem solving, judgment, and learning

Managing Emotions

- Modulating emotions – returning to one’s balance point

Recognizing emotional contexts – tracking affect shifts in emotionally arousing situations

Preparing for future emotions – predicting expected feelings

Modeling emotions – demonstrating emotional competence in various situations

CULTIVATING VALUES (VALUING)

Valuing Self

Building identity– aligning actions and values

Evolving a personal philosophy– bringing meaning to life

Trusting self – having an accurate sense of self-efficacy

Caring for self – attending to one’s personal emotional, physical, and spiritual needs

Reflecting – increasing one’s self-awareness

Valuing Natural Laws

Appreciating diversity – valuing differences as a measure of a healthy ecosystem and social system

Valuing nature – seeking to understand and harmonize one’s actions with natural laws

Valuing family/significant others – enjoying closeness in a central social group

Being spiritual – experiencing awe

Refining Personal Values

Identifying values – labeling main beliefs

Exploring beliefs – questioning, researching the basis of one’s values

Clarifying one’s value system – achieving consistency

Validating values – taking personal ownership from experiential “tests”

Aligning with social values – acting according to mutually empowering ethics

Accepting ownership – assuming responsibility for one’s behavior

DEVELOPING ONESELF (INTERNALIZATION)

Synergizing Feelings

Associating feelings – connecting emotions such as love and fear

Interpreting feelings – understanding the social and historical meaning of emotions

Analyzing feelings – understanding causes of complex emotions

Predicting feelings – anticipating future emotions

Objectifying emotions – temporarily suspending feelings

Exploring emotions – learning and growing from both pleasant and unpleasant emotions

Facilitating Personal Development

Recognizing personal potential – identifying strengths and areas of improvement

Seeking assessment – focusing on obtaining realistic growth- enhancing feedback

Seeking mentoring – seeking relationships that will challenge one’s growth

Being patient – being able to “stay the course”

Challenging Self

Exploring potential – developing a life vision

Expanding identity – engaging life in new ways

Being courageous – taking risks to embrace the unknown

Being proactive – planning ahead to create new opportunities

Growing culturally – applying insights from human differences

Being empathic – responding affirmatively to complex differences in others’ world views

Committing Beyond Self

Committing to caring – taking long-term responsibility

Accepting outcomes – adjusting to reality

Acting on beliefs – being ethically consistent

Enhancing self-esteem – activating one’s potential

Maturing – increasing one’s integration and complexity

Self-actualizing – taking responsibility for the future

COGNITIVE DOMAIN

PROCESSING INFORMATION

Collecting Data (from a disorganized source)

Observing – seeing details in an environment/object

Listening – purposeful collection of aural data

Skimming – inventorying using key prompts

Memorizing – active mental storage of information

Recording – transcribing key information

Measuring – obtaining data using a predetermined scale

Generating Data (to fill a void)

Predicting – forecasting from experience

Estimating – approximating from mathematical models

Experimenting – inferring from empirical study

Brainstorming – gathering ideas from previous experience

Organizing Data (for future use)

Filtering – selecting data based on criteria

Outlining – identifying primary and subordinate groupings

Categorizing – associating data with established groups

Systematizing – designing an organizational framework

Retrieving Data (from an organized source)

Recognizing patterns – perceiving consistent repetitive occurrences

Searching – locating information within a system

Recalling – retrieving from memory

Inventorying – retrieving from collective memory

Validating Information (for value)

Testing perceptions – verifying based on interpretations

Validating sources – verifying based on credibility

Controlling errors – verifying based on procedures

Identifying inconsistency – detecting outliers/anomalies

Ensuring sufficiency – verifying data quantity/quality to suit the context

CONSTRUCTING UNDERSTANDING

Analyzing (characterizing individual parts)

Identifying similarities – recognizing common attributes of parts

Identifying differences – recognizing/distinguishing attributes of parts

Identifying assumptions – examining preconceptions/biases

Inquiring – asking key questions

Exploring context – seeing the relationship of parts to the environment

Synthesizing (creating from parts)

Joining – connecting identifiable parts

Integrating – combining parts into a new whole

Summarizing – representing the whole in a condensed statement

Contextualizing – connecting related parts to the environment

Reasoning (revealing meaning)

Interpreting – adding meaning for better understanding

Inferring – drawing conclusions from evidence and logic

Deducing – arriving at conclusions from general principles

Inducing – arriving at a general principle by observing specific instances

Abstracting – describing the essence of an idea, belief, or value

Validating Understanding (for reliability)

Ensuring compatibility – testing consistency with prior knowledge

Thinking skeptically – testing against fundamental principles/schema

Validating completeness – checking for missing aspects

Bounding – recognizing the limits of the application of knowledge

APPLYING KNOWLEDGE

Performing with Knowledge (in real context)

Clarifying expectations – defining proficiency level

Strategizing – planning how to use knowledge

Using prior knowledge – integrating unprompted knowledge

Transferring – using ideas in a new context

Modeling (in abstract context)

Analogizing – representing similar elements in dissimilar contexts

Exemplifying – showing by example

Simplifying – representing only primary features

Generalizing – transferring knowledge to multiple contexts

Quantifying – representing with numbers or equations

Diagramming – clarifying relationships through visual representation

Being Creative (in new contexts)

Challenging assumptions – exploring possibilities by relaxing constraints

Envisioning – imagining desired conditions

Linear thinking – generating new ideas from previous ideas

Divergent thinking – taking variety of positions to stimulate ideas

Transforming images – manipulating images to gain new insight

Lateral thinking – generating new ideas from associations

Validating Results (for appropriateness)

Complying – comparing results with accepted standards

Benchmarking – comparing with results from best practices

Validating – using alternative methods to test results

SOLVING PROBLEMS

Identifying the Problem (to establish focus)

Recognizing the problem – stating what is wrong or missing

Defining the problem – articulating a problem and need for solution

Identifying stakeholders – naming key players/ audiences

Identifying issues – inventorying key stakeholder desires and concerns

Identifying constraints – recognizing limitations to solutions

Structuring the Problem (to direct action)

Categorizing issues – grouping by underlying principles

Establishing requirements – articulating solution criteria

Subdividing – separating into sub-problems

Selecting tools – finding methods to facilitate solution

Creating Solutions (for quality results)

Reusing solutions – adapting existing methods/results

Implementing – executing accepted solution practices

Choosing alternatives – selecting alternatives using criteria

Harmonizing solutions – fitting components into holistic solution

Improving Solutions (for greater impact)

Generalizing solutions – modifying for broader applicability

Ensuring robustness – modifying to fit more contexts

Analyzing risks – identifying external sources/impacts of error

Ensuring value – testing against requirements and constraints

CONDUCTING RESEARCH

Formulating Research Questions (to guide inquiry)

Locating relevant literature – searching out seminal sources

Identifying missing knowledge – determining gaps in community understanding

Stating research questions – asking empirically answerable questions

Estimating research significance – forecasting the value/ impact to the community

Writing measurable outcomes – specifying deliverables from research

Obtaining Evidence (to support research)

Designing experiments – specifying observable parameters and sampling

Selecting methods – determining research procedures

Extracting results – analyzing data to produce quality characterizations

Replicating results – duplicating experiments and findings

Discovering (to expand knowledge)

Testing hypotheses – discerning significant effects

Reasoning with theory – explaining data with accepted knowledge

Constructing theory – formulating new conceptual structures

Creating tools – adapting knowledge for practitioners

Validating Scholarship (for meaningful contribution)

Defending scholarship – presenting within disciplinary performance expectations

Responding to review – improving one's scholarship based on community input

Confirming prior work – adding credibility to a body of knowledge

Judging scholarship – evaluating scholarship against criteria

Appendix 3: Distribution of Learning Skills Reported in Each Domain

Affective Domain	55.52%
Internalizing	0.00%
Challenging Self	0.00%
Growing culturally	0.00%
Exploring potential	0.00%
Expanding identity	0.00%
Being proactive	0.00%
Being empathic	0.00%
Being courageous	0.00%
Committing Beyond Self	0.00%
Self-actualizing	0.00%
Maturing	0.00%
Enhancing self-esteem	0.00%
Committing to caring	0.00%
Acting on beliefs	0.00%
Accepting outcomes	0.00%
Facilitating Personal Development	0.00%
Seeking mentoring	0.00%
Seeking assessment	0.00%
Recognizing personal potential	0.00%
Being patient	0.00%
Synergizing Feelings	0.00%
Predicting feelings	0.00%
Objectifying emotions	0.00%
Interpreting feelings	0.00%
Exploring emotions	0.00%
Associating feelings	0.00%
Analyzing feelings	0.00%
Organizing (Managing Oneself)	51.96%
Managing Emotions	7.47%
Recognizing emotional contexts	0.00%
Preparing for future emotions	0.00%
Modulating emotions	7.47%
Modeling emotions	0.00%
Managing Performance	16.01%
Rehearsing	5.69%

Cognitive Domain	44.48%
Applying Knowledge	7.12%
Being Creative	1.07%
Transforming images	0.71%
Linear thinking	0.36%
Lateral thinking	0.00%
Envisioning	0.00%
Divergent thinking	0.00%
Challenging assumptions	0.00%
Modeling	1.78%
Simplifying	0.36%
Quantifying	0.00%
Generalizing	0.71%
Exemplifying	0.00%
Diagramming	0.36%
Analogizing	0.36%
Performing with Knowledge	4.27%
Using prior knowledge	1.07%
Transferring	1.78%
Strategizing	0.71%
Clarifying expectations	0.71%
Validating Results	0.00%
Validating	0.00%
Complying	0.00%
Benchmarking	0.00%
Conducting Research	0.00%
Discovering	0.00%
Testing hypotheses	0.00%
Reasoning with theory	0.00%
Creating tools	0.00%
Constructing theory	0.00%
Formulating Research Questions	0.00%
Writing measurable outcomes	0.00%
Stating research questions	0.00%
Locating relevant literature	0.00%
Identifying missing knowledge	0.00%

Affective Domain	55.52%
Preparing	7.12%
Orchestrating emotions	0.00%
Committing to the future	1.78%
Challenging standards	0.71%
Being self-efficacious	0.00%
Being decisive	0.71%
Regulating Self	28.47%
Responding to requests	2.49%
Recognizing dissonance	1.42%
Prioritizing	0.71%
Managing Resources	14.23%
Managing dissonance	0.00%
Being self-disciplined	9.61%
Receiving (Being Open to Experience)	0.36%
Experiencing Emotions	0.00%
Responding to aesthetics	0.00%
Laughing	0.00%
Grieving	0.00%
Feeling secure	0.00%
Feeling loved	0.00%
Feeling joyful	0.00%
Exploring Self	0.00%
Perceiving reactions	0.00%
Observing self	0.00%
Listening to self	0.00%
Identifying emotions	0.00%
Body awareness	0.00%
Exploring Surroundings	0.36%
Being positive	0.36%
Being playful	0.00%
Being open	0.00%
Being curious	0.00%
Being active	0.00%
Responding (Engaging in Life)	3.20%
Addressing Life's Changes	3.20%
Responding to failure	0.00%

Cognitive Domain	44.48%
Estimating research significance	0.00%
Obtaining Evidence	0.00%
Selecting methods	0.00%
Replicating results	0.00%
Extracting results	0.00%
Designing experiments	0.00%
Validating Scholarship	0.00%
Responding to review	0.00%
Judging scholarship	0.00%
Defending scholarship	0.00%
Confirming prior work	0.00%
Constructing Understanding	12.46%
Analyzing	2.14%
Inquiring	1.42%
Identifying similarities	0.00%
Identifying differences	0.00%
Identifying assumptions	0.36%
Exploring context	0.36%
Reasoning	5.34%
Interpreting	2.14%
Inferring	0.00%
Inducing	0.71%
Deducing	2.49%
Abstracting	0.00%
Synthesizing	2.14%
Summarizing	0.36%
Joining	1.42%
Integrating	0.00%
Contextualizing	0.36%
Validating Understanding	2.85%
Validating completeness	2.49%
Thinking skeptically	0.00%
Ensuring compatibility	0.00%
Bounding	0.36%
Processing information	22.78%
Collecting Data	7.83%

Affective Domain	55.52%
Persisting	1.07%
Coping	0.00%
Believing in oneself	0.00%
Appreciating evaluation	0.00%
Accepting help	2.14%
Emoting	0.00%
Respecting	0.00%
Loving	0.00%
Giving	0.00%
Comforting	0.00%
Caring	0.00%
Leveraging Life's Successes	0.00%
Seeking assessment	0.00%
Responding to success	0.00%
Celebrating	0.00%
Being humble	0.00%
Acknowledging others	0.00%
Valuing/Cultivating Values	0.00%
Refining Personal Values	0.00%
Validating values	0.00%
Identifying values	0.00%
Exploring beliefs	0.00%
Clarifying one's value system	0.00%
Aligning with social values	0.00%
Accepting ownership	0.00%
Valuing Natural Laws	0.00%
Valuing nature	0.00%
Valuing family/significant others	0.00%
Being spiritual	0.00%
Appreciating diversity	0.00%
Valuing Self	0.00%
Trusting self	0.00%
Reflecting	0.00%
Evolving a personal philosophy	0.00%
Caring for self	0.00%
Building identity	0.00%

Cognitive Domain	44.48%
Skimming	0.36%
Recording	5.34%
Observing	1.07%
Memorizing	0.36%
Listening	0.71%
Generating Data	1.78%
Predicting	0.00%
Experimenting	0.00%
Estimating	1.42%
Brainstorming	0.36%
Organizing Data	5.34%
Systematizing	3.20%
Outlining	1.42%
Filtering	0.00%
Categorizing	0.71%
Retrieving Data	7.47%
Searching	2.14%
Recognizing patterns	0.36%
Recalling	4.27%
Inventorying	0.71%
Validating Information	0.36%
Validating sources	0.00%
Testing perceptions	0.00%
Identifying inconsistency	0.00%
Ensuring sufficiency	0.00%
Controlling errors	0.36%
Solving Problems	2.14%
Creating Solutions	0.00%
Reusing solutions	0.00%
Implementing	0.00%
Harmonizing solutions	0.00%
Choosing alternatives	0.00%
Identifying the Problem	1.42%
Recognizing the problem	1.42%
Identifying stakeholders	0.00%
Identifying issues	0.00%

Cognitive Domain	44.48%
Identifying constraints	0.00%
Defining the problem	0.00%
Improving Solutions	0.00%
Generalizing solutions	0.00%
Ensuring value	0.00%
Ensuring robustness	0.00%
Analyzing risks	0.00%
Structuring the Problem	0.71%
Subdividing	0.00%
Selecting tools	0.71%
Establishing requirements	0.00%
Categorizing issues	0.00%