

Using Critical-Thinking Skills to Substantiate or Challenge Controversial Claims Endorsing a Myriad of Weight-Loss Products



RECOMMENDATION

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ABSTRACT

This exercise engages students in critically evaluating weight-loss products and programs. Specific objectives are to investigate, analyze, and substantiate claims made by the weight-loss industry and interpret how these claims may be fraudulent, misleading, or perhaps even truthful.

Key Words: Critical thinking; claims for weight loss.

○ The Problem to Be Investigated

Data from the Centers for Disease Control (CDC) show that the percentage of the US population that is overweight has increased from 44.7% in 1962 to 66.0% as of 2004. Obesity has more than doubled, increasing from 13.3% to 32.1% (CDC, 2010a). Health practitioners, nutritionists, and educators report that a number of physiological problems are caused or exacerbated by excess weight and obesity. These problems include type II diabetes, hypertension, elevated cholesterol, and increased risks of heart disease, stroke, joint problems, and certain types of cancer (Bray, 1992; Schiff, 2009). Other consequences, such as depression, infertility, sleep disorders, and discrimination have also been linked to obesity (Price et al., 1987).

Body mass index (BMI), an indicator of the appropriateness of a person's weight for their height, is often used as an indicator of a healthy body weight (CDC, 2010b). Adults who fall into the healthy category (BMI 18.5–24.9) are in energy balance; their calorie consumption generally equals their calorie expenditure. Adults who fall in the overweight (BMI 25.0–29.9) or obese category (BMI > 30) are in positive energy balance. Their caloric intake is in excess of their energy expenditure, and the extra energy is not wasted but is stored compactly as fat. The most healthful and logical strategies for moving into the healthy body weight category are to decrease caloric intake and increase energy expenditure by using energy stores of fat.

For most people, weight gain is slow and occurs over a number of years. In trying urgently to improve their health, many overlook the fact that weight loss will also take time. Looking for quick results, they turn to nutritional supplements, food substitutes, motivational books, commercial weight management programs, and prescription weight-loss products. Such dieting aids can be important if they provide the structure

Dietary aids are often used as a “Band-Aid” treatment for losing weight.

and accountability that a number of individuals feel they lack. However, such aids are often used as a “Band-Aid” treatment for losing weight; they are not a substitute for the self-discipline and behavioral changes that need to be addressed for lifelong correction.

Proper weight management is an important topic for adolescents and young adults. Frequently, attaining a healthy weight leads to social acceptance and peer approval. It is no wonder that thousands of weight-loss programs and products are available. The fact that so many new ideas are introduced each year indicates that many of these products don't work or don't prevent weight regain (Wooley & Garner, 1991).

○ Activity Objectives

The goal of the exercise presented here is to provide students with an activity that engages them in critically evaluating weight-loss products and programs using the logical tools of the investigative process. Specific student objectives are to investigate, analyze, and substantiate claims made by the weight-loss industry and interpret how these claims may be fraudulent, misleading, or perhaps even truthful. Specific objectives for the teacher are

to (1) employ the fundamentals of inquiry as a means to introduce students to the basics of nutrition science; (2) provide criteria that students can use as a framework for recognizing information applicable to their assignment; (3) enable students to use various media to gather information; and (4) engage students in a variety of written, oral, and peer communication skills so that they may share and build upon the outcomes of their investigation.

○ Background Information

This exercise has been used for the past 10 years at Bethel University in a general education course entitled “Nutrition: The Total Diet.” Students investigate the science of interactions between proper nutrition and weight control and management and examine the appropriate, ethical, and perhaps limited use of technology as a means to reverse obesity. From a curricular point of view, this course focuses on a technological issue (reversing obesity) that poses current and emerging choices (food philosophies and weight management) and rests on a body of scientific understanding (nutrition science, appetite, and hormonal imbalance).

Ideally, this activity should be used as a capstone assessment of a nutrition unit. The scientific and technological prerequisites should include food philosophies and food pyramids, food labels, bioavailability of ingested food, energy balance, and the concept of weight management. Most of these topics are not covered exhaustively in high school biology textbooks. However, “MyPyramid Tracker” (<http://www.mypyramid.gov>) is an adequate online resource that can walk students and educators through interactive tutorials such as “Assessing Food Intake” and “Assessing Physical Activity,” providing the background information that will enable students to get the most out of this project.

○ Project Guidelines

The following outline provides a logical order of questions deliberately pointing students toward decision-making criteria. While a more succinct form of the project outline is found in Figure 1, the probing questions and elaborations that follow are intended to provide the instructor with further topical insight to guide the students toward measurable outcomes. The conceptual order should help students avoid plagiarism and reasonably deduce and form opinions. It will also help the teacher to remain objective in grading and facilitate consistency as students intuitively compare their own projects with those of their peers.

I. Preliminary Remarks

- What is your topic?
- Why did you choose to investigate this topic?
- Explain how your topic fits into the appropriate product category.
- What would motivate a person to use this product?
- What population would likely choose this product?

II. Product Development

- Who developed this product or program and under what set of circumstances?
- Is the product marketed under more than one name?
- What are the competing products or programs?
- What scientific support is there? Are there any peer-reviewed articles?

III. Mechanisms & Approaches to Use

- What body system(s) does the product or program affect?
- Is there a recommended administration and scheduled use for this program?

IV. Benefits & Risks

- How effective is this product?
- What are the advantages of this product/program over another?
- Are there any negative side effects or disadvantages of this product? Has use of the product been shown to have long-term consequences?

V. Public Scrutiny

- Is there any independent literature that supports or challenges the manufacturer’s and/or marketer’s claims?
- Are finances an issue?

VI. Personal Assessment

- Are there data or testimonials of sustained weight loss for over 1 year?
- Is the weight loss slow?
- Is exercise recommended?
- Are attitudes and eating behaviors changed?
- Would you recommend the use of this product or program as it is intended?

Figure 1. Project guidelines for reviewing commercial food supplements/substitutes, commercial approaches to weight management, and clinical drug therapies used in weight management.

An introductory exercise prior to presentation of the project guidelines would be to have the students brainstorm the questions that they feel they would need to know in order to evaluate product claims.

I. Preliminary Remarks

What is your topic? Students can pick from a variety of products organized around the themes of commercial food supplements/substitutes, commercial approaches to weight management, and clinical drug therapies that are used in weight management (Table 1). While it is best to let students choose their own topic, instructor approval is recommended. This will prevent multiple projects on topics that are very similar, which would slowly erode audience interest during presentations. Helpful online sources of ideas and critiques regarding fad diets and weight loss products can be found at the Web sites listed below under Resources.

Why did you choose to investigate this topic? This personal testimony is very important. I have found that most students will have one or more stories of how someone in their family has experienced the frustration of managing their weight.

Explain how your topic fits into the appropriate product category. Not only does this help the instructor to organize classroom presentations, it also enables the student to rationalize categorical fit as suggested by the product manufacturer.

What would motivate a person to use this product? Weight-loss products may claim to promote weight loss by burning calories faster, reducing appetite, providing more energy to work off stored fat, blocking the absorption of fat-related nutrients, or enhancing the evacuation of intestinal contents. But being thinner may not be the only motivation. Other reasons may include the desire to decrease blood pressure, control type II diabetes, reduce the onset and pain of crippling joints, remain competitive in sports, engage in a lifelong exercise program, and perhaps even to promote relationships by eliminating size-related prejudices.

What population would likely choose this product? Not all products or programs are a fit for all ages. For example, the “Shredded Wheat Diet” might be a completely safe way to lose a few pounds if you temporarily want to fit into a prom dress. But the same program would be a nutritional compromise for an obese elderly person who cannot exercise. Several members of the population may also be restricted by financial constraints, transportation to meetings, and accessibility of food plans.

II. Product Development

Who developed this product or program and under what set of circumstances? Some weight-loss products have a credible origin in the medical or nutritional community. Unless the

Table 1. Some of the products, programs, and therapies used in weight management. Other categories might include books, infomercials, over-the-counter products, herbal treatments, and nutraceuticals.

Commercial Food Supplements/ Substitutes	Commercial Program	Clinical Drug Therapies
Activia	Atkins Diet	Gastric Bypass
Alli	Blood Type Diet	Meridia
Anatrim	Body for Life Diet	Redux
Dexatrim	Fat Loss for Idiots	Tenuate
Fish oil	Hallelujah Diet	Xenical
Flax seed	hCG Diet	
Green tea	Hollywood Diet	
Hoodia	Jenny Craig	
Hydroxycut	LA Weight Loss	
Isagenix	Mannatech System	
L-carnitine	Mediterranean Diet	
Lycopene	Metabolic Typing Diet	
Noni juice	Nutrisystem	
Omega 3	Protein Power Plan	
Red Bull	Richard Simmons	
Ripped Fuel	Slim Fast	
Soy	Special K Diet	
Splenda	Sugar Busters	
Vitamin C	The Shredded Wheat Diet	
Xenadrine	The South Beach Diet	
Zantax-3	Weigh Down Diet	
Zyatrim	Weight Watchers	

developers have had personal experiences in weight management, the marketing for these products may promise results that are too good to be true. Motivation, product efficacy, and product history will be different for pharmaceuticals that are subject to approval by the Food and Drug Administration than for many health-club and infomercial labels.

Is the product marketed under more than one name? This may reflect a slight change in composition or formulation. The uninformed consumer may interpret this as product improvement or greater selection for diverse needs. Careful review of product labels and ingredients may help assess whether cost differences are honest and appropriate.

What are the competing products or programs? There are several commercial weight programs that vary in minor ways. Is there anything unique that makes one program a better choice for a given individual with a given set of circumstances?

What scientific support is there? Are there any peer-reviewed articles? These questions lead to the very basics of scientific reasoning. Was a hypothesis being tested that resulted in the manufacturer's claims? Was there an experimental protocol containing a control group as well as treatment groups? If so, was the project subjected to a double-blind design (i.e., both the subjects and the analyzers were unaware of group assignments)? Were the results statistically analyzed to demonstrate that results and outcomes

were due to the treatment and not to random or placebo effects? Were there any attempts to submit results for review among professionals? Who would tend to benefit most from the results: the consumer or the manufacturer?

III. Mechanisms & Approaches to Use

What body system(s) does the product or program affect? To make connections to human biology, students should address what body system(s) their topic may address. For example, evaluating products that are claimed to affect enzyme activity or nutrient absorption will require some knowledge of digestive physiology. From an organismal perspective, several systems will interact and can be affected. Examples to consider are as follows. (1) Several over-the-counter supplements, particularly those that contain caffeine or analogous ingredients, may affect the cardiovascular system by raising blood pressure. This would be counterproductive in an obese individual who may already be experiencing hypertension (see <http://www.nhlbi.nih.gov/hbp/hbp/hdrf.htm>). (2) Diets high in fiber need to be accompanied by a large consumption of water. Failure to do so may result in constipation and flatulence. (3) Some diet regimes deprive the body of certain nutrients. While the intention may be to reduce caloric intake, appetite cravings may overcome behavioral willpower. (4) To control appetite, some weight-loss products may boost metabolism. This can result in sleeplessness and mood alterations that interfere with school, work, and family relationships. In other words, the psychology of the individual cannot be uncoupled from the biology.

Is there a recommended administration and scheduled use for this program? Is program management influenced and affected by age, gender, and exercise? Is there a timeline illustrating how and when results may best be achieved? Are directions given in a manner designed to promote user compliance?

IV. Benefits & Risks

How effective is this product? It is actually helpful to encourage the student to give the product any benefit of the doubt and state possible positive results that may occur if the consumer is able to comply with the directions.

What are the advantages of this product/program over another? Since there are so many variations on a theme, this challenges the student to completely review other programs and discern redundancies.

Are there any negative side effects or disadvantages of this product? Has use of the product been shown to have long-term consequences? For example, will fat-soluble vitamins get flushed down the toilet if you are taking prescriptions or fat substitutes that block the absorption of fat? Fatty stool is undesirable and may make it difficult to control defecation. An additional challenge from the use of over-the-counter supplements is that withdrawal from these compounds often demonstrates their addictive potential. Furthermore, very low-calorie diets may actually reduce metabolism, resulting in rapid weight regain when the individual returns to previous or even newly controlled eating habits.

V. Public Scrutiny

Is there any independent literature that supports or challenges the manufacturer's and/or marketer's claims? Infomercials and celebrity endorsements are

often used to develop public trust. In most cases, students can find both positive and negative testimonials online. Students should carefully consider whether or not the company promoting the product employed the principal investigators and reviewers. Students are often frustrated by the fact that they are unable to find any information that resembles a scientific approach demonstrating effectiveness. They need to be assured that if their search has been thorough, the lack of information may indicate that the product is supported only by hype. Can one reasonably know that the product is not simply flushing money down the toilet?

Are finances an issue? Several commercial products or programs recommend one-on-one counseling, potentially at a cost that may be restrictive. Membership fees may deter some individuals, as well as purchase of products uniquely enforced by the program and locations of recommended meetings. If insurance covers the cost, is that reason in and of itself to use the product?

VI. Personal Assessment

Are there data or testimonials of sustained weight loss for over 1 year? Successful long-term weight loss is defined as at least 10% of initial body weight kept off for at least 1 year (Wing & Hill, 2001). Does a lack of product information documenting sustained weight loss indicate ineffectiveness?

Is the weight loss slow? Weight loss should be slow to be maintained; the recommended rate is no more than 1–2 pounds per week (Brown, 2005). Would extreme weight loss as a result of sustained low caloric intake be difficult to maintain? Would this cause a dieter to return to their previous caloric intake and possibly experience a rapid (and depressing) weight regain? (Amigo & Fernández, 2007).

Is exercise recommended? Does the product claim successful weight loss without the use or addition of physical activity? Does the product ignore the topic altogether? Physical exercise is generally recommended to help lose as well as manage weight. Exercise while dieting should not be done to the extent that it deprives the body of energy required for basal metabolism.

Are attitudes and eating behaviors changed? A shortcoming in several products and programs is that while strict adherence to instructions may result in significant weight loss, no education is provided on how to eat normally once the weight is lost. The consumer will likely not elect to continue to buy commercially based food preparations or prescription drugs once their weight has reached an acceptable level. Without a proper understanding of the what, when, and why of eating, the ills of portion distortion and a return to previous food habits may result in weight regain.

Would you recommend the use of this product or program as it is intended? Each student project will be unique. One approach that I have found beneficial is for students to summarize their recommendations using a “good, bad, and ugly” framework. Can something “good” or positive be stated about the product? For example, does it initiate an exercise program, successfully jump-start motivation, or avoid the elimination of a basic food group? Can something “bad” be stated about the product, reflecting a strong reason why the product should not be used? For example, does it ignore modification of eating behavior and habits? Are certain food groups completely avoided? Are enough calories consumed to avoid lethargy and a loss of willpower? Can something “ugly” (in contrast to bad) be stated about the product, indicating that its use would result in side effects or long-term consequences? For example, could high-energy-producing compounds become addictive? Does the cost of the product limit how long an individual may be able to maintain the product plan? Might rapid weight loss result in rapid weight gain when use of the product is discontinued?

○ Assessment

The type of assessment activities developed for this project should reflect the academic level of the students, the class size, the amount of

time given for the project, and whether the project is to be completed inside the classroom environment or as homework. For larger classes, organizing projects into small groups may be optimal for time management. For smaller classes, I find that friendly competition among individuals helps to drive their motivation.

When students are completing their project as an extension of their homework, I frequently use several popcorn-style questions to check on their progress. For example: What is your product and what category does it fit into? Why did you choose this product? How successful has the online search for information been? Are there any celebrity endorsements? At this point, can you say anything really interesting about your project? Have you found anything about this product that is “too good to be true”? What is your gut response so far? I find that responses to these quick inquiries are not intimidating and tend to engage students’ interest as they connect peer responses to their own.

The most meaningful use of this activity occurs when the students orally present an executive summary of their project using PowerPoint. For a 10–12 min presentation, I would recommend a minimum of six to eight slides. It is helpful to have printouts of the slides at the time of the presentation so that the instructor can focus on the presentation and follow up with written comments later. An anticipatory set such as a visual aid, the product itself, something tasty (or not so tasty), commercial diet trackers or planners, music from a workout routine (such as found in the Richard Simmons Plan) effectively serve as a hook to engage the rest of the class. To format their presentation, students frequently use the “good, bad, and ugly” concept. It is also important to follow through with a Q & A so that the presenters can demonstrate that their project knowledge is greater than the prepared verbal presentation. My experiences using this activity affirm that students are engaged more cognitively when articulating to their peers than if they were only studying the materials (Tanner, 2009).

A sample rubric for evaluating oral presentations is presented in Table 2. These objective criteria do not directly assess all the framework components listed in Figure 1; rather, they evaluate how well the students are assimilating the information as they go through the inquiry. Other presentation criteria, such as voice projection, posture, visibility, group dynamics, and participation, can also be assessed. Free online resources such as RubiStar (<http://rubistar.4teachers.org/index.php>) and Teachnology: The Online Teacher Resource (<http://www.teach-nology.com/tutorials/teaching/rubrics/>) can help teachers compose a rubric that uniquely expresses their own objectives.

For curricular standards that require a writing competency, a written summary of the results of the project is a reasonable assessment. The logical order of the framework should help students respond to questions using their own words. Furthermore, the guidelines found in Figure 1 (I–VII) could serve as a template for creation of a rubric. The written project should include a reference section. Specific requirements depend on information accessibility. The Internet will likely be the first resource that students will employ because it is fast, accessible, and is their main way of accessing information. Research indicates that computers in science education have the potential to enable students to gain higher-learning outcomes in ways not previously experienced in the science classroom (Derry & Lajoie, 1993; Jonassen & Carr, 2000; Marbach-Ad et al., 2008). Traditional references such as textbooks (biology, physiology, chemistry, health, and nutrition), articles from published and online journals, magazines, and personal contacts should also be included.

○ Challenges

The logistics of organizing the activity will likely be the greatest challenge for the teacher. At the college level, one or two class periods for introducing the project is enough for students to independently or collaboratively work toward an assigned 1-week deadline for oral

Table 2. A sample rubric for evaluating an oral presentation of a nutrition project.

Objective	1	2	3	4	Value
Preparedness	Student is completely prepared; rehearsal is evident	Student seems pretty well prepared but could have used a few more rehearsals	Student is somewhat prepared, but it is clear that rehearsal was lacking	Student does not seem at all prepared to present	
Anticipatory Set	Student uses one or two props (the product itself, visuals, samples to taste, video from Web site, etc.) that show considerable work/creativity and make the presentation better	Student uses one prop that shows considerable work/creativity and makes the presentation better	Student uses one prop that makes the presentation better	Student uses no props OR the props chosen detract from the presentation	
Product Positives	Student shows a full understanding of what good may come from the proper use of the product	Student shows a good understanding of what good may come from the proper use of the product	Student shows a partial understanding of what good may come from the proper use of the product	Student does not seem able to discern whether or not the product may have any positive value	
Product Negatives	Student shows a full understanding of why the product is not good and should not be used	Student shows a good understanding of why the product is not good and should not be used	Student shows a partial understanding of why the product is not good and should not be used	Student does not seem able to discern whether the product should not be used	
Product Side Effects	Student shows a full understanding of the potential for unwanted side effects and long-term consequences that may occur with use	Student shows a good understanding of the potential for unwanted side effects and long-term consequences that may occur with use	Student shows a partial understanding of the potential for unwanted side effects and long-term consequences that may occur with use	Student does not seem able to discern whether or not the product has unwanted side effects or long-term consequences of use	
Comprehension	Student is able to accurately answer almost all questions posed by classmates about the topic	Student is able to accurately answer most questions posed by classmates about the topic	Student is able to accurately answer a few questions posed by classmates about the topic	Student is unable to accurately answer questions posed by classmates about the topic	
Quality of Information	Information clearly relates to the main topic, and several supporting details and/or examples are provided	Information clearly relates to the main topic, and one or two supporting details and/or examples are provided	Information partially relates to the main topic, but no details and/or examples are given	Information has little or nothing to do with the main topic	
Time Limit	Presentation is 10–12 minutes long	Presentation is 8–10 minutes long	Presentation is 6–8 minutes long	Presentation is less than 6 minutes OR more than 12 minutes long	
Appearance and Organization	PowerPoint presentation is clearly organized and helps to visualize the material	PowerPoint presentation shows only partial organization of headings and subheadings to help visualize the material	PowerPoint presentation format does not help to visually organize the material	PowerPoint presentation format is absent	
Background Sources	Several background sources were used and cited correctly	A few background sources were used and cited correctly	A few background sources were used but were not cited correctly	No background sources were used	

Notes: In this example, the objective criteria do not directly assess all the framework components outlined in Figure 1, but rather the student's understanding of the positives, negatives, and long-term consequences of product use. Other presentation criteria that reflect student preparation and comprehension are also included. This rubric was constructed by implementing several ideas found at RubiStar, a free online tool to help teachers create high-quality rubrics (<http://rubistar.4teachers.org/index.php>).

presentations and a 2- to 3-week deadline for a written paper. I have found that giving a sample presentation during this time provides an effective model for depth of coverage, completeness, and development of conclusions.

At the high school level, the activity could be completed after a unit on nutrition or simply given as an independent assignment over the course of the term (the latter would require additional guidance from the teacher). A creative option would be to integrate the activity across other curricular disciplines, such as physical education, health, speech, and composition, as well as use of the library for finding resources.

Another important challenge to both teachers and students is the use of assessments other than those that evaluate memorization. The inquiry nature of this nutrition project encourages students to reason and think logically about the relationships that exist between evidence and explanations (Davis, 1990; National Research Council, 1996), and not simply accept and restate everything that is communicated by the weight-loss industry. These approaches require more work and force students to take more responsibility for their learning (Wright, 2006).

○ Successes

The main goal of this activity is to promote the critical-thinking skills that are needed to substantiate or challenge the claims that endorse weight-loss products. While the goal of evaluating such products is not new, the focus on organizing the activity around an inquiry-based format provides more novel advantages. Using the investigative outline, students initially create a knowledge base that leads them toward making an evaluation on the basis of a set of criteria (Jonassen & Carr, 2000). Thus, this learner-centered teaching practice “uses” content rather than “covering” content as a means to achieve higher-order learning goals (Weimer, 2002). This project framework may subsequently provide the structure to evaluate other controversial health claims such as those associated with body enhancements and physical performance.

This activity also aligns with the *National Science Education Standards* (National Research Council, 1996). Several of the concepts that underlie the “Science as Inquiry” standard are integrated throughout the project outline. In addition, the evaluation of weight management strategies and personal health are also applicable to the “Science and Technology” and “Science Perspectives and Personal Health” standards, demonstrating how technological achievements in science contribute directly to the scientific process of trying to understand why we eat as we do.

Furthermore, this topic is biologically relevant to the lifelong learning processes that can promote health. With the advancement of biotechnology comes a greater understanding of how our bodies work and what it takes to keep them operating at optimal conditions. If students are unsatisfied with their body image, they may turn to food substitutes, commercial weight management programs, and clinical drug therapies for help. This activity encourages them to use rational criteria to make wise decisions, become better consumers, and place more emphasis on long-term outcomes (Jason, 2007). Ideally, the inquiry approach will extend their thinking as they construct new knowledge bases rather than simply reproducing them (Jonassen & Carr, 2000).

○ Resources

<http://www.faddiet.com/>
http://www.everydiet.org/fad_diets.htm
<http://www.mypyramid.gov/>
<http://www.thedietchannel.com/faddiets.htm>
<http://www.win.niddk.nih.gov/publications/myths.htm#dietmyths>

References

- Amigo, I. & Fernández, C. (2007). Effects of diets and their role in weight control. *Psychology, Health & Medicine*, *12*, 321–327.
- Bray, G.A. (1992). Physiology of obesity. *American Journal of Clinical Nutrition*, *55*, 488S–494S.
- Brown, J.E. (2005). *Nutrition Now, 4th Ed.* Belmont, CA: Wadsworth.
- Centers for Disease Control and Prevention. (2010a). Overweight and obesity: data and statistics. Available online at <http://www.cdc.gov/obesity/data/index.html>.
- Centers for Disease Control and Prevention. (2010b). Overweight and obesity: defining overweight and obesity. Available online at <http://www.cdc.gov/obesity/defining.html>.
- Davis, N.T. (1990). Using concept mapping to assist prospective elementary teachers in making meaning. *Journal of Science Teacher Education*, *1*, 66–69.
- Derry, S.J. & Lajoie, S.P. (1993). A middle camp for (un)intelligent instructional computing: an introduction. In S.P. Lajoie & S.J. Derry (Eds.), *Computers as Cognitive Tools* (pp. 1–14). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Jason, H. (2007). Becoming a truly helpful teacher: considerably more challenging, and potentially more fun, than merely doing business as usual. *Advances in Physiology Education*, *31*, 312–317.
- Jonassen, D.H. & Carr, C.S. (2000). Mindtools: affording multiple knowledge representations for learning. In S.P. Lajoie (Ed.), *Computers as Cognitive Tools. Volume II: No More Walls* (pp. 165–196). Mahwah, NJ: Lawrence Erlbaum Associates.
- Marbach-Ad, G., Rotbain, Y. & Stav, R. (2008). Using computer animation and illustration activities to improve high school students' achievement in molecular genetics. *Journal of Research in Science Teaching*, *45*, 273–292.
- National Research Council. (1996). *National Science Education Standards*. Washington, DC: National Academy Press.
- Price, J.H., Desmond, S.M., Krol, R.A., Snyder, F.F. & O'Connell, J.K. (1987). Family practice physicians' beliefs, attitudes, and practices regarding obesity. *American Journal of Preventative Medicine*, *3*, 339–345.
- Schiff, W.J. (2009). *Nutrition for Healthy Living*. New York, NY: McGraw-Hill.
- Tanner, K.D. (2009). Talking to learn: why biology students should be talking in classrooms and how to make it happen. *CBE Life Sciences Education*, *8*, 89–94.
- Weimer, M. (2002). *Learner-Centered Teaching: Five Key Changes to Practice*. San Francisco, CA: Jossey-Bass.
- Wing, R.R. & Hill, J.O. (2001). Successful weight loss maintenance. *Annual Review of Nutrition*, *21*, 323–341.
- Wooley, S.C. & Garner, D.M. (1991). Obesity treatment: the high cost of false hope. *Journal of the American Dietetic Association*, *91*, 1248–1251.
- Wright, R. (2006). Walking the walk. *CBE Life Sciences Education*, *5*, 311–312.

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