Dave's Top Ten Lists:

Dave's Top Ten Best AP Stats Resources:

1. Listserve: http://apcentral.collegeboard.com/apc/public/homepage/7173.html
2. AP Central: http://apcentral.collegeboard.com/apc/public/courses/teachers_corner/2151.html
3. Good textbook (BVD, YMM…)
4. Activity-Based Statistics (supplementary books: teacher and student)
5. Workshop Statistics (textbook/applets by Alan Rossman and Beth Chance)
6. Internet:
   Jared Derksen's Top Ten Listserve FAQ:
   http://web.mac.com/mrmathman/MrMathMan/Top_10.html
   StatsMonkey:
   http://web.mac.com/statsmonkey/APStats_at_LSHS/Teacher_Activities.html
   Tuvalabs.com (basic data analysis tool; can upload files, write own activities)
   StatKey (simulation and analysis tool)
   Rossman/Chance Applets
   DASL: http://lib.stat.cmu.edu/DASL/
   Stu Schwartz: http://www.mastermathmentor.com/mmm/default.aspx?page=APStat
   Rice University applets: http://www.ruf.rice.edu/~lane/stat_sim/
   ltcconline.net/greenl/java/Statistics/catStatProb/categorizingStatProblems.html
7. YOU! Read the news and find cool topics to discuss.
8. AP Workshops and Summer Institutes
9. Fathom, StatCrunch (online), JMP, Minitab, etc. (generally NOT Excel)
10. After three years: apply to be a reader!

Dave's Top Ten Regression Concepts To Know:

1. Describe scatterplots: shape, strength, scatter, outliers…
2. Correct r-squared interpretation, in context
3. Slope interpretation ("according to the linear model"…in context)
4. Residual plots
5. Appropriateness vs. strength of model
6. Beware cause and effect
7. Correlation is for quantitative, linear associations only
8. Regression formulas (from formula sheet)
9. Y-intercept interpretation
10. Beware NO cause and effect

Dave's Top Ten General Perspective Truths

1. "NEVAH GIVE UP" –Churchill
2. The news is full of relevant statistics—bring them into the classroom!
3. It takes several years to get comfortable
4. MANY teachers have gone through the same (difficult) learning curve.
5. It is VERY different than teaching mathematics.
6. There is a plethora great resources available.
7. Therefore, you must learn how to filter well.
8. DON'T try to do it all in a year…or two…or three. (I think it takes at least four.)
9. My personal journey has given me fresh motivation to continue teaching…
10. Be confident that you're doing a noble and valuable service to their future!

Dave's Top Ten Teaching Tips for AP Stats:

1. Use AP Exam problems AOAP (As Often As Possible)
2. Write early and often! Give projects/reports/Investigative Tasks.
3. Get real! Do experiments, simulations, activities, surveys, etc. in class; use real data
4. Have high expectations
5. Encourage, give perspective often
6. Make sure breaks are breaks for students (and you!)
7. Discuss newspaper/radio/web/TV articles (surveys, ebola studies, etc.)
8. Use technology!: Fathom, JMP, Minitab StatCrunch, TI's, applets, Tuvalabs.com
9. Recharge yourself: professionally and personally, workshops, become an AP Reader, take regular breaks!
10. Never Give Up! It's a marathon, both for students and for you (getting comfortable)

Dave's Top Ten Big Ideas of Statistics:

1. Variability permeates life: in data, samples, summary statistics, etc.
2. Correlation does *not* *necessarily* imply causation.
3. Inference using statistics is tenuous, at best. We prove little, but suggest a lot.
4. Models (linear, normal, probability, etc.) are useful, but not perfect.
5. Sample statistics have mathematically predictable behavior (probabilistically)
6. Fundamental statistical reasoning is needed to interpret the world.
7. Anyone can learn statistical concepts through hard work, good study habits and working with others.
8. Good communication skills are necessary to complement statistical reasoning (explaining/justifying conclusions using data and statistical analysis)
9. There are many different ways to approach a statistical problem (different ways of gathering and analyzing data).
10. Reasonable people may come to different conclusions based on the same data (if they use different assumptions and methods of analysis).

Dave's Top Ten AP Statistics Exam Hints:

1. Always include context.
2. Show work for calculations.
3. Answer the question asked.
4. Be very careful with dangerous words:
   normal, bias, standard deviation, mean, it, correlation, variation, confounding, etc.
5. Include and label graphs.
6. Link conclusions to evidence.
7. Control your reader. (Include enough explanation so they know what you mean without making assumptions.)
8. Answer the question, then stop writing. You run the risk of saying something wrong or giving parallel answers.
9. When comparing two distributions (or answers, methods, groups, etc.), include comparative language. Do not just list facts for each.
10. Have a plan for using your time (especially for the Investigative Task).

Dave's Top 10 Best Practices for AP Exam Prep:

1. Use FRAPPY's
   http://apstatsmonkey.com/StatsMonkey/FRAPPYs.html
2. Read EDG compilation on my web site
   http://noblestatman.com/AP_Stats_Workshops/Miscellaneous_files/APS.EDG.ExamPrep.Advice.pdf
3. Use Student Communication Errors document
   (11 common errors using student responses from AP Exams)
   http://www.noblestatman.com/AP_Stats_Workshops/AP_Exam_files/Student.Comm%27n.Errors.pdf
4. Write early and often.
5. Give feedback early and often.
6. Use AP problems and rubrics early and often.
7. Use AP problems soon after covering material (as review for chapter tests) to show students that the test has some very easy problems…give confidence.
8. Read Chief Reader's Reports.
   2015: http://media.collegeboard.com/digitalServices/pdf/ap/ap15_statistics_student_performance_qa.pdf
9. Reserve time before the exam to have students take full practice tests (use real previous exams).
10. Use Classifying Statistics Problems web site to practice matching the correct statistical procedure to the story/data.
    http://www.ltcconline.net/greenl/java/Statistics/catStatProb/categorizingStatProblems.html

Joan Garfield's article:[1]

I believe that we really want students to gain an understanding of ideas such as the following:

(a) The idea of variability of data and summary statistics.
(b) Normal distributions are useful models though they are seldom perfect fits.
(c) The usefulness of sample characteristics (and inference made using these measures) depends critically on how sampling is conducted.
(d) A correlation between two variables does not (automatically) imply cause and effect.
(e) Statistics can prove very little conclusively although they may suggest things, and therefore statistical conclusions should not be blindly accepted.

Statisticians are already discussing these general notions as central goals for student learning. A list of prioritized topics is given by Hogg (1990) based on a discussion at a workshop of statisticians regarding what the goals for an introductory statistics course should be. Moore (1991) has also specified core elements of statistical thinking in terms of what students should be learning in statistics classes.

In addition to concepts, skills, and types of thinking, most statisticians would probably agree that we also have attitude goals for how we would like students to view statistics as a result of our courses. Such attitude goals are:

(a) It is important to learn some fundamentals of statistics in order to better understand and evaluate information in the world.
(b) Anyone can learn important ideas of statistics by working hard at it, using good study habits, and working together with others.
(c) Learning statistics means learning to communicate using the statistical language, solving statistical problems, drawing conclusions, and supporting conclusions by explaining the reasoning behind them.
(d) There are often different ways to solve a statistical problem.
(e) People may come to different conclusions based on the same data if they have different assumptions and use different methods of analysis.

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[1] Garfield, Joan. "How Students Learn Statistics." *International Statistical Review* 63 (1995): 25-34

Garfield and Ben-Zvi's Eight Learning Principles:[2]

1. Students learn by constructing knowledge.
2. Students learn by active involvement in learning activities.
3. Students learn to do well only what they practice doing.
4. It is easy to underestimate the difficulty students have in understanding basic concepts of probability and statistics.
5. It is easy to overestimate how well students understand basic concepts.
6. Learning is enhanced by having students become aware of and confront their errors in reasoning.
7. Technological tools should be used to help students visualize and explore data, not just to follow algorithms to pre-determined ends.
8. Students learn better if they receive consistent and helpful feedback on their performance.

David Moore's article:[3]

Recommendations of the ASA/MAA Joint Curriculum Committee

1. Emphasize the elements of statistical thinking:
   (a) the need for data,
   (b) the importance of data production,
   (c) the omnipresence of variability,
   (d) the measuring and modeling of variability.

2. Incorporate more data and concepts, fewer recipes and derivations. Wherever possible, automate computations and graphics. An introductory course should:
   (a) rely heavily on real (not merely realistic) data,
   (b) emphasize statistical concepts, e.g., causation vs. association, experimental vs. observational and longitudinal vs. cross-sectional studies,
   (c) rely on computers rather than computational recipes,
   (d) treat formal derivations as secondary in importance.

3. Foster active learning, through the following alternatives to lecturing:
   (a) group problem solving and discussion,
   (b) laboratory exercises,
   (c) demonstrations based on class-generated data
   (d) written and oral presentations,
   (e) projects, either group or individual.

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[2] Garfield, Joan, and Dani Ben-Zvi. "How Students Learn Statistics Revisited: A Current Review of Research on Teaching and Learning Statistics." *International Statistical Review* 75.3 (2007): 372-96

[3] Moore, David S. "New Pedagogy and New Content: The Case of Statistics." *International Statistical Review*, 65 (1997), 123–137.