Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
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Time After Time in the Teen Years

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How many times have you asked yourself this question about your students, “What are they really about?” If you are referring to students in grades 7-12, then you probably ask yourself this question frequently. This period in our lives called adolescence is complex, dynamic, influential in determining one’s future, and survivable. It is important for us, teachers of adolescents, to be as knowledgeable about our clients as possible, to aid us in being a positive influence on them throughout this period. This unit offers many opportunities for learning experiences for students, as well as teachers. What it attempts to do is present a body of knowledge about American adolescents and the myriad factors that bear upon their development. The current research may or may not confirm what you already believe to be true about adolescents. I hope that some new information is presented to you in this unit. What we learn about American youth today can translate into some rethinking about how we view and teach them. If we can learn more about the forces that are at work in adolescents’ lives, then we will be better equipped to guide them. Also, students learning about their peers and themselves may cause them to reevaluate some of their goals, philosophies and habits.

A second major portion of this unit is the presentation of material related to statistics. This portion of the narrative is my own assessment of what is appropriate for students to learn in the seventh and eighth grades. The math objectives for these levels include many of the subskills that are necessary to perform the mathematics related to statistics, i.e. finding percentages, calculating the arithmetic mean, graphing. Many of these objectives are also included in the curricula for other grades, making this unit easily adaptable for older or younger students. Further, many of the topics discussed in this unit are appropriate to the teaching of disciplines other than math, i.e. social sciences, career education.

These two goals of teaching students about themselves and about statistics will converge in an attempt to have students focus on the single question, “How do teenagers spend their time?” This question was the focus of a study conducted by a group of social scientists at the University of Chicago. The book about this project, *Being Adolescent: Conflict and Growth in the Teenage Years* , and Laurence Steinberg’s book, *Adolescence* , are the two major sources for this unit. I would strongly recommend them both.

WHAT IS ADOLESCENCE?

Adolescence is a period in our lives that is marked by three major areas of change: biological, cognitive and social. These changes are universal—everyone undergoes them. They are interrelated, occur at varying rates and times, and they all have an impact on the psychological development of the individual. The effects of these changes, however, are not universal. The effects are varied due to the environments in which these changes occur. These *contexts of adolescence* shape the psychological development and behavior of the individual. In our society, and in other modern societies, four main contexts of adolescence exist: family, peer groups, school and work. All of these contexts have undergone a number of changes in America over the years, especially the last several decades. Society itself has changed in America. A teenager in America in 1920 had a reality that was very different from the reality of an American teenager in 1985. Two teenagers in America growing up in different settings in 1985 would experience different realities, resulting in differing patterns of psychological development between them. It is important, therefore, that we take a look at these contexts, noting the changes that have occurred in each and the influence each has on the development of the adolescent, in order to better understand adolescence. Much of what is contained here is taken from Steinberg's book. The reader should refer to it for further details.

FAMILY

The American family has undergone a number of changes over the past forty years, or so. Following World War II certain changes in the nature of work set off a trend of increased participation by women in the work force. The Women's Movement changed attitudes about the roles of women in society, opening new opportunities for women of all ages. The Women's Movement also created a rethinking of child-rearing practices in America, i.e. men taking on a greater role, day care centers. Further, changes in values and attitudes which allowed for a diversity of life styles and family patterns have also had a profound effect on American family life, i.e. cohabitation, single parent families, divorce. The American family *has* changed, as has American society. Two fundamental aspects of families and the youngsters in them have not changed, however. First, the family is an extremely important force regarding the development of the adolescent and, second, regardless of the structure of the family (single parent, working mother, etc.), having warm family relationships is one of the most powerful predictors of healthy psychosocial growth in adolescents. Generally, a family with warm relationships, a balance between restrictiveness and autonomy, and a keen sense of the needs and competencies of the adolescent is likely to produce young adults who are more self directed and socially adept than those adolescents who were raised by authoritarian or permissive parenting.

The family is a system which, like all systems, must change as the circumstances change. As the needs of family members change, the family system changes to maintain equilibrium. As the child grows and reaches new levels, the expectations and roles for that family member will, or should, also change. The family responds to these changes in the child in such a way as to recognize these changes and adapt to them.

PEER GROUPS

Adolescents in our society spend a large amount of their time with peers. Changes in schools, work settings, and the family have led to the prominence that the peer group has in the psychosocial development of the adolescent. Is this rise to prominence of the peer group a problem, or is it a necessary part of life in Modern America? On one side society has led to a “youth culture”, the values of which run counter to the values of adults; and on the other side are those who maintain that peer groups provide a vital function in the socialization of the adolescent. Nearly twenty-five years ago, James Coleman wrote that the increased age segregation of our youth has led to the prominence of the peer group in the development of adolescents, and has created their alienation from the goals and values of adult society. When Coleman asked of adolescents, “What does it take to get into the leading clique in your school?”, he found that their responses were: athletic prowess, personality and good looks for boys, and personality, good looks, good reputation and good clothes for girls. Good grades were at the bottom of everyone’s list. Coleman’s study was largely an indictment of contemporary society, placing all of the ills of growing up in it on the segregation of adolescents from adults. Coleman ignored the possibility that peer groups may actually be necessary to teach adolescents certain things and the impracticality of teaching young people in the same fashion as was done prior to World War II.

Our society makes it necessary to teach young people in large groups, in order to have reasonable assurance that the same messages are getting across to them. All individuals in our society are expected to learn the same set of norms. Modern society has created a system in which adolescents play an increasingly valuable role in teaching one another. According to the noted anthropologist, Margaret Mead, ours is a configurative culture. In a configurative culture changes occur so rapidly that much of what parents teach their young is outdated by the time they become adults. For adolescents in modern America, what peers teach them may be as important, if not more important, than what their parents teach them. The computer is an excellent means of illustrating this. Living with computers is easy for today’s youth. Computers have been a part of the world in their lifetimes. Very little anxiety is created within a youngster who is sitting in front of a computer and much of what they learn about computers is derived from their peers. On the other hand, many adults who are confronted by the green screen and blinking cursor experience anxiety often.

Adolescent peer groups are usually structured around cliques, groups of two to twelve individuals that structure the adolescent’s social activities. At first they are same sex groups, them change to mixed groups, then to opposite sex dyads as the adolescent moves from early to middle and late adolescence. The study of cliques is not as simple as the above may suggest. Occasionally, several cliques come together to form “crowds”, loosely organized around a particular activity or function, i.e. a school dance, a fundraising project, a party. Crowd formation seems to be a transitional stage that precedes dating. The crowd offers the sanctuary of the same sex peer group while affording the adolescent an opportunity to closely check out the opposite sex. Dating usually follows, generally led by the leaders of the cliques. Others follow as they resolve the dating issue within themselves. Middle adolescence is characterized by heterosexual cliques and crowds, although they are not quite ready to split off in opposite sex pairs. Eventually, as they move into late adolescence couples split off from the crowd, maintaining a loose tie With the larger group. This association with the larger group is through contact with other couples. The concept of the couple as the focus of social activity remains through adulthood. Early adolescence provides the seeds of an adolescent’s capacity for close relationships through friendships with same sex peers.

Cliques serve as a source of identity by acting as a reference group, a standard against which the adolescent evaluates his experiences, learns about himself, and forms judgments about his abilities. Cliques also serve as

a provider of identity in the way one appears to other adolescents. Adolescents judge one another by the company they keep. Initially, cliques are formed on the bases of: same age, same sex, same social class and same race. However, the above list changes, eventually, to include two basic types of orientation, school orientation and youth culture orientation. These two determinants of clique formation provide a basis for friendships outside of one's sexual, age and status groups.

SCHOOLS

It is probably safe to say that no other institution of modern societies is a important to the development of the lives of young people as are schools. Schools are where our youth are supposed to become prepared for life as adults. From one decade to the next policymakers have taken schools from one extreme to the next; first advocating more academic rigor in the curriculum, then arguing for social relevance of course content, then back to academic rigor. The pendulum is likely to continue its swing in the years to come. Research finds that the most important factor regarding what goes on in schools is what occurs in the classroom. Effective schools are those which have effective teachers, those who are sincere, warm, supportive, and a talented. As we become more attuned to the nature of cognitive development during adolescence and the problems of adolescence we will become better able to develop strategies that promote intellectual development and the love of learning within our students, and produce clear roles for our schools in preparing them for adult life.

WORK

Work is a significant factor in the lives of today's adolescent in America, more so than of those in other modern societies. In Japan, for example, adolescents spend a mere 2-3 hours per week in part-time jobs, while American adolescents work an average of 18-22 hours per week in part-time jobs. There have also been some changes in youth employment over the last several decades in our country. In 1940 the number of youths who were employed on a part-time basis was negligible. In 1980 approximately 2/3 of American adolescents were employed part-time. There are common assumptions that work helps to build an adolescent's character and increase his self-reliance. These assumptions may or may not be true, however, there are certain trade-offs which are made for the working adolescent. More time spent at work translates into less time devoted to school, family and friends. Further research into the work settings of adolescents and the impact of work on their development is needed.

THE CHICAGO STUDY

The study at the University of Chicago was conducted in 1977. Its purpose was to gather information about being a teenager in America, hoping to yield an accurate account of what teenagers do with their time. The study involved seventy-five high school students from a community near Chicago. The community is a mixture of urban and suburban living, uppermiddle and lower-middle class families, and subject to the same pressures as any community in America today. The high school is more than eighty years old with a student population of approximately 4,000. The 75 students included relatively equal numbers of males and females from every socio-economic segment of the community. Also, there were proportionately representative numbers from

each of the four grades in the high school. The data were collected in a unique fashion. Participants were issued electronic pagers which signaled the students at random times during the waking hours. Students were asked to complete a questionnaire as soon as possible after being beeped. The questionnaire focused on the following: the location at the time of signal, the activity in which the student was engaged, the student's mood, the quality of the student's participation, the student's desire to be engaged in the activity, and whether others were present. Extra space was provided for the student to provide Comments, also. The students involved in the study are not a representative sample of American adolescents. The authors of the study do not try to make a claim that they are. What the study does is provide us with a picture of what is like to an adolescent within this group of 75 young adults. The thoughts and responses of these students can be useful to us in our own work with our students.

If there is one thing that we can say about adolescence with complete predictability it is that it is unpredictable. The Chicago study found that adolescent experiences are marked by frequent and drastic mood changes, some of which occur within very short periods of time. These mood swings illustrate that the process of socialization of our youth is a never-ending conflict between the goals and rules of society and the instincts, values and habits of the adolescent. In this period of choice the adolescent is pulled and stretched in a number of directions by a variety of forces. How the individual copes with these conflicting forces is what determines what the person is likely to become in later life. Conflict is a necessary and inevitable part of our lives. If it is channeled into a constructive mode of thinking and behavior, the individual grows. If it is not, then the individual languishes, beginning a downward spiral that mitigates against growth.

Csikszentmihalyi and Larson, in their book about the Chicago study, borrow a term from physics and information theory that is helpful in understanding the above—entropy. In physics, entropy describes a loss of energy in a system that is due to some disorder in that system. In information theory, entropy refers to some disorder in transmitting or receiving patterns that result in a loss of meaning. Psychic entropy; therefore, is the individual's reception of conflicting information in consciousness, causing unpleasant experiences and a diminished capacity to perform.

Psychic entropy in the short term manifests itself as guilt, anxiety, alienation, frustration,or boredom. Positive growth can be realized by an individual who has such entopic experiences, that is, if the individual perceives them as temporary setbacks, and uses this feedback to turn one's attention inward to resolve them, e.g. a person who is guilt ridden over letting down a loved one by not fulfilling a commitment, who then analyzes the situation and resolves either to follow through on commitments, or not to make commitments that cannot be kept.

There are four basic forms of disorder in consciousness that are termed psychic entropy: bad moods, passivity, diminished or absent motivation, and the inability to focus one's attention. These experiences are inevitable in growing up and living. One point of view of the authors of the Chicago study is that a consistent pattern of disorder in consciousness may be permanently damaging to a person's growth and productivity in adult life.

The opposite term of psychic entropy is psychic negentropy, order in consciousness. It is a state in which the person feels "whole", positive and enthusiastic. It is a person performing at one's optimal level. There are four main characteristics of psychic negentropy: positive feelings toward self and others, a sense of competence, one's identification with the goals of the activity, and effective concentration. Psychic negentropy is not static. It is dynamic. New order is created out of experience and the self is constantly growing. Psychic negentropy does not seek to return to a previous state of order, however, since it is out of experience that growth and

new order evolve. An illustration of this is a boy who has been jilted by his girlfriend. He works this out in his mind by rationalizing that there are other girls out there, ones whom he can love and will love him in return. However, the boy does not return to a previous state of innocence which existed before this incident. New order is created from this experience, and the boy becomes cautious about with whom he shares his love.

Can the above be useful to teachers and students? I believe that we can analyze instances whereby students have had good and bad experiences, and search for the underlying causes. If a student, for example, has a bad experience in math class, was it due to his (the student) not being prepared for class, or were there other reasons beyond his control? If the student was, indeed, not prepared for class, then what were the causes of this? Was it because he cut yesterday's class and missed the lesson, or that he wasn't paying attention? Perhaps the student needs to become better organized concerning his use of time? If only we can get our students to view the larger picture:.

As parents and teachers we cannot help but ask ourselves whether we are doing the right thing. Often, perhaps always, it is too late when the answer is realized—the youngster is now an adult. We can, however, look closely at indicators that exist in their present lives which will help us to assess their progress (or lack of it) toward a productive adult life. How the adolescent spends his time, the quality of his experiences, his habits and activities are all good indicators of the kind of person he is likely to become.

Where do adolescents spend their time? What do they do with their time? With whom do they spend their time? Laurence Steinberg calls these areas the contexts of adolescence. Csikszentmihalyi and Larson refer to them as the external landscape. We will be looking at these areas to map the daily experiences and interactions of adolescents.

LOCATIONS

Adolescents spend their time in three locations: the home, school and in public. Locations concern the geographical places in which adolescents spend their time, as opposed to contexts, which also take into account the activities in which they are engaged and the people they are with. Each of these domains is ruled by laws distinct from those of the remaining two. In the home the adolescent must work out a way of life with parents and, oftentimes, siblings. As the child grows within the family new responsibilities and expectations are created. The school is an institution that requires adherence to rules and regulations into which the adolescent has little or no input. The adolescent has no choice but to abide by them. In public (shopping centers, parks, places of entertainment) the rules change. Behavior is governed by norms that are more flexible than those of the home or school. The home is where adolescents spend approximately 41% of their waking hours. Of the four main contexts of teen life the family plays the most important role in the adolescent's life, in many ways. The adolescent depends on parents for financial support and basic survival necessities. Emotionally, the home provides the first supports for their development and well-being. The home is also the source of some of teenagers' greatest conflicts. The adolescent and parents are locked in a battle over how the adolescent should expend his psychic energy. The teen's struggle for autonomy offers many opportunities for growth, if that struggle is handled correctly. Younger adolescents in the Chicago study spent approximately 25% of their waking hours with their families, while older adolescents spent 15% of their time with theirs. There is a gradual progression of directing one's time from family to peers as one grows older, in preparation for one's role as an adult.

School is where socialization is supposed to occur. The teenager's consciousness is subjected to the attempts by adults to modify it, direct it toward the goals of the school, so that it conforms to adult standards. The school is also a place where the adolescent is exposed to the socializing influences of his peers. Of the 31% of time spent in school, 2/3 of that time was spent in classes and the remaining 1/3 was spent in fringe areas (cafeteria, corridors, student center). In the school in the Chicago study, as in others like it, these fringe areas are claimed by cliques of every variety (jocks, druggies, eggheads, Blacks, Italians).

The public places within which these adolescents exist are varied and, as mentioned earlier, governed by varying rules. IN some cases, such as work, the adolescent's time is structured in terms of adult goals. Churches, restaurants and stores demand adult-like behavior. Behavior at concerts, movies and dances are more influenced by the values of the youth cultures. Other locations are a mix of adult goals and youth values, such as the automobile. While driving a car the teenager must conform to the rules of the road, if he wants to continue to drive, while the automobile is also a means to power (acting out one's wishes) and freedom (withdrawal from adult scrutiny).

The school and the home are environs in which one can easily identify the seat of control by either adults or peers. The public sphere, however, is one in which adult behavior is required and opportunities exist for unsupervised activities. Teen life is split between adult values domination and peer values domination.

ACTIVITIES

How much time is spent in educational activities and leisure activities is crucial in determining the kind of adult the adolescent is likely to become. There are three main categories of adolescent activities:. productive, maintenance and leisure. The Chicago study received 2,700 reports from the participants during the course of the study. Of these reports 29% reported what may be classified as productive activities, ones which are primarily education related. Thirty-one percent concern maintenance activities, such as eating, bathing, resting, dressing, etc. The remaining 40% of their time was spent in leisure activities: watching T.V., hobbies, socializing, reading not related to school, games, etc. Compared to other technologically advanced societies, American adolescents spend considerably less time studying. For example, Japanese students reportedly spend approximately 59 hours per week in school or studying (Japanese Finance Ministry). In addition to spending more time each day in school, Japanese students attend school an average of 243 days per year. This is approximately 60 days greater than the average American school year. Similar figures are also reported for students in Soviet Russia. The other side of this coin is time spent working at a job. Forty-one percent of the adolescents in this study reported being employed, working from 5 to 33 hours per week, for an average of 18 hours. These figures are also in sharp contrast with Japanese youth, who work much less (approximately 2 hours per week).

With whom do adolescents spend their time? The reports of the students in the study indicate that they are seldom in the company of adults. Approximately 20% of their time is spent with family and a very small portion of this time is spent with parents only. Other adult company adds a mere 2% to this time. A bit more than one quarter of their waking hours is spent in solitude, and more than half of their time is spent with peers (23% with classmates, 29% with friends). These figures clearly illustrate the influence that peers have on adolescents, or, at least, the potential for having a great influence.

What does the teenager's life feel like? What is the internal landscape? We have taken a look at where and

with whom a teenager spends his time. This gives us a fairly clear picture of the investment of time. What about the investment of psychic energy? The question of when psychic entropy and negentropy occur will give us a clearer picture of *how* life is experienced. For teens to develop into productive individuals, who contribute to society, it is necessary for them to experience enjoyment and order in life. If they derive enjoyment from school we can be reasonably assured that they will turn out to be motivated adults. If they receive enjoyment *only* from idle interactions with peers or in disruptive activities, then we have cause for concern about what they will become in adult life.

The authors of this study consider intrinsic motivation to be the single best indicator of harmony in teenagers' consciousness. To measure this dimension they asked students to rate how much they "wished" to be doing the activity in which they were engaged when signaled. This measure was the student's own rating of whether they were doing something because they had to, or because they were truly invested in it. They were also asked to measure their emotional state and cognitive efficiency.

The results of this aspect of the study are astonishing. Twenty-five percent of the time they reported a wish to be doing what they were doing. They reported varying degrees of wishing to be doing something else the rest of the time. However, their ratings of emotional harmony (favorable moods) are positive 71% of the time. Approximately 6% of the time they reported being as happy and cheerful as the rating scale allowed. As one might expect these teenagers were more likely to report positive feelings and high concentration and activation in activities and locations that are less structured by adults (sport, hobbies, games, etc.).

One might be inclined to think that an adolescent's life is structured to such a point as to be bland and routine. The data reveal that this is not so. The teenager is subject to numerous mood swings in a single day. The students in the study were randomly chosen to provide greater detail about their daily lives for a full week. The reports clearly show that teenagers' moods fluctuate dramatically. A student could be ecstatic one minute, and in a depressive mood the next. Two case studies are presented in the book. The first one is about a 16 year old "druggie", Greg. Through his dress and behavior Greg makes it clear that he rejects the school's goals and the values of the so-called straight community. School is boring to him, and his only excitement is derived from hanging out with his friends, male and female, and in getting high. Greg has mood changes, as does any other adolescent, yet his moods generally stay on the negative side.

Kathy is seventeen years old. She is a good student with clear life goals. She has a serious commitment to playing orchestral music. Her moods swing from utter boredom to exhilaration just as quickly as Greg's, however, Kathy appears to have more negentropic experiences in a variety of settings. Kathy experiences frustration, yet has learned to channel this frustration into something constructive. For example, when she has a poor practice session with her violin, Kathy uses this feedback to her advantage, making her next one better than ever. Psychic entropy for Kathy seems to improve her performance because she has learned how to use it.

Each of these two students has mood swings. When one places these moods on charts it is easy to see that Greg's moods are consistently on the negative side. His only negentropic experiences come from getting high or hanging out with his friends. Kathy has moods that go as far on the negative side as Greg's, yet she has negentropic experiences from a variety of settings, including school. The major difference regarding these moods is how each student handles the challenges and frustrations of their daily lives. For Kathy, she has learned the meaning of the adage "when life deals you lemons, make lemonade."

The daily lives of adolescents are fraught with things that can, and often do, go wrong. It is not realistic for adolescents to try to avoid conflict and entropy in their experiences. Growing up in our modern society

presents a predicament for adolescents to meet standards set up by adults, or reject them. Many adolescents are rejecting these standards, refusing to enlist in the established social order. Each generation has had its own fashion of displaying this rejection; the 50s had beatniks, the 60s had hippies, the 70s had punks, and the 80s have the “what’s in it for me’ kids. Suicide, the third highest cause of teenage death, and drug abuse are just two examples of adolescent rejection of the norms of society. The most important question for today’s adolescents is not “how do I avoid conflict? it should be “How can I learn to live with conflict and use it to promote my personal growth?”

THE FLOW EXPERIENCE

The flow experience is described by Csikszentmihalyi as existing in a special environment, a separate world, in which the consciousness feels as if it belongs to a larger system, acting in complete harmony with the goals of the activity. Enjoyable experiences come from clear challenges that require interaction within a set of rules that guide one’s psychic energy. The flow experience provides clear goals and feedback and causes one to lose self-consciousness. A sense of exhilaration and a “natural high” are the feelings one gets from the flow experience. Flow experiences produce enjoyment for the individual, adolescent or adult. Unfortunately, for most adolescents enjoyment is produced nearly always from leisure activities. The Chicago study surveyed adolescents, seeking information on what produces flow for them. Most of their responses were about activities from the leisure group. There were, however, several responses that included some classes at school. It would seem that the teacher and other classmates helped to create the flow experience as much as the nature of the subject.

Why is it that many people have flow experiences outside of leisure activities, i.e. work setting, school,etc? The answer lies in the skills that the individual possesses and the challenges presented by the activity. If an activity is not challenging enough to meet the skills of the individual, boredom results. When an activity presents challenges that far exceed the skill one possesses, the result is frustration and anxiety. Only a match between skill and challenge can produce the flow experience. The challenge of the activity must exceed the skill by a margin that is attainable by the individual. A good example is that of a youngster who plays the piano. If he is left to practice the basics that were mastered long ago, he will become bored. No one enjoys having to practice something that has clearly been shown to be mastered. On the other hand, if this youngster is presented with a classical piece that is far beyond his skill level, then he will become frustrated. As new skills are mastered by the youngster new challenges must be presented that promote further growth in his ability to play the piano. Growth occurs as a result of mastering new skills, paving the way the introduction of skills that are of a greater complexity, and so on.

The implications of the flow experience for teaching should be clear. The teacher should be aware of the skills levels of each of his pupils, and at the same time continue to challenge each one of them. This is no easy task for a teacher of 125 students each day, yet it is not impossible. If we can provide enough flow experiences early in their school careers, our students may derive enough enjoyment from learning to help them through the later years.

ON TEACHING STATISTICS

The material and statistical information presented in the narrative would likely be of little value to the students. It does, however, provide a framework about which our students can learn about themselves, as individuals and groups. The framework offers a number of topics that could be used in open discussions involving students and teachers, perhaps leading to a more sophisticated use of statistics than what is provided in the lessons that follow. First, they must learn the basics of statistics. Why should we teach statistics? Hardly a day goes by that we are not presented with some new data from a poll or study. Newspapers, magazines and television give us a constant stream of data concerning a variety of subjects. Students should learn to interpret these data that have become a part of our daily lives. Government agencies produce tons of statistical surveys, expecting us to understand them, or not.

Statistical knowledge has applications to subjects other than mathematics. While it is true that some mathematical training is necessary to deal with statistical matter in a sophisticated manner, meaningful experiences with statistics can be gleaned even at the primary school levels. Nearly every subject in the curriculum can incorporate even a small amount of statistics.

Statistics can be found in areas that require very little coaxing by the teacher to get students motivated to learn, such as sports. Nearly every student has a favorite sport or sports figure. The motivation in these cases is provided free of charge. All one needs to do is to help students discover the application of statistics to these areas of high interest. Such a strategy is recommended if the teacher deems it necessary for his class. This will enable students to build up their confidence before moving on to other applications.

The relevance of statistics to the real world can be readily shown to students. Statistics is one way that we can represent what occurs in the real world. We must present students with the basics to be able to deal with the mass of data that is thrown at us every day, for as the world becomes increasingly complex even the smallest, most personal decisions will depend on how well we understand these data. A prime illustration of this is the projections for job availability in the year 2000. Positive growth is projected in all areas of engineering and health related fields, while negative growth is projected for college professors. It would be wise to prepare for a career that has a promising future.

What follows is one way of teaching statistics. Some of the lessons are rather elementary. I am assuming nothing regarding students' prior knowledge and experience. Only the teacher is able to judge which classes can handle the later material without taking on the earlier lessons. The lessons move from having nothing to do with adolescence, building toward the necessary skills to accomplish the work in the culminating study.

LESSON OUTLINE

The statistical calculations will we employ in this unit will be limited to measures of central tendency. A *measure of central tendency* is an index of central location employed in the description of frequency distributions. The only measures we will learn about in this unit are:. mean, median and mode. Our study of these measures will be basic, leaving out the more complex and sophisticated descriptions involving dispersion of data. We will simply involve ourselves in finding the central values for the data collected.

1.1 THE ARITHMETIC MEAN

Time allotted: one class period plus homework assignment The *mean* is a measure of central tendency that acts like the fulcrum on a seesaw. The mean balances the scores on either side of it. The way to calculate the mean is to find the sum of the scores or values, then divide the sum by the number of scores. The algebraic form is:

(figure available in print form)

X = the mean (“X bar”)

N = the number of scores

· = the mathematical verb which tells us to sum the scores

Give students a set of scores to find the mean of:.

14, 24, 29, 19, 12, 21, 17 The sum is 136. Dividing 136 by 7 gives us 19.4285

We can leave the number as is, or we can round it to any of several places.

Give students enough practice in class, and assign a suitable homework.

1.11 THE EFFECT OF EXTREME SCORES ON THE MEAN

Time allotted: one class period plus homework Above we described the mean as a fulcrum of a seesaw. Ask students about how to balance a seesaw that has one person who is heavier than the person on the opposite end of the seesaw. The answer is that the heavier person has to sit closer to the fulcrum, or the lighter person must move away from it. When working with numbers, how does an extreme measure or score effect the mean?

Take the set of scores that were used as an example in 1.1, and add an extreme score to it Below is that set with 100 added to it.

14, 24, 29, 19, 12, 21, 17, 100 Now have students find the mean of this set. 236 = 29.5

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This second mean is approximately 50% larger than the first by adding the extreme value to the set. The mean is very sensitive to extreme scores. Try this again with the first set adding a low extreme score to it.

Give practice in class in calculating the means of sets which have extreme scores in them. One suggested way to do this is to use some of the previous lesson’s work, adding extreme scores to them.

1.2 THE MEDIAN

Time allotted: one class period plus homework The *median* is that score or value which has an equal number of scores on either side of it. The median is the exact middle of a set of values. The 5Oth percentile is the median. (If an odd number of scores exists in a set, then the middle number is the median. An even number of scores requires finding the mean of the scores on either side of the middle.)

Ordering the scores from 1.1 gives us: 12,14,17,19,21,24,29

The median is 19. Three scores lie on either side of 19.

1.21 THE EFFECT OF EXTREME SCORES ON THE MEDIAN

Time allotted: incorporate into the previous lesson Does adding an extreme score have any effect on the median? Let us use the scores from 1.11:

12,14,17,19,21,24,29,100 Because this set of numbers has an even number of elements (8), we have to find the mean of the two numbers on either side of the middle, 19 and 21. The median now is 20. In this case the median is effected only slightly.

Give students an opportunity to check this out in a few other cases.

1.3 THE MODE

Time allotted: one class period The *mode* is very easy to identify in a given set of values. It is the value which appears with the greatest frequency in a set of values. In the case of the sets previously mentioned there is no mode. This happens occasionally.

Give students practice in finding the mode of sets of values.

2.0 CLASS PROJECT

Decide upon a topic for a class project which will yield a set of values that students can use to practice finding mean, median and mode. Suggested topic: height of students in class

Time allotted: one class period

Measure each student’s height in centimeters.

Put the individual heights in order, from tallest to shortest.

2.1 Find the mean height of the class (one class period) 2.2 Find the median height of the class 2.3 Find the mode (if one exists) 2.4 Discussion of findings

Time allotted: one class period Refer to the findings in the lessons involving the class project mentioned above. Draw students into a discussion of how these three measures of central tendency relate to one another. How do they differ?

Have students order themselves by height in front of the class.

Which student is in the exact middle? Is this person the median or the mean?

Refer to the mean value obtained. Which person(s) are that height? Which persons represent the extremes in this class?

2.5 GRAPHING

Time allotted: one class period Have students to construct histograms of the data collected in this project. The teacher should construct a larger graph of the sane data to be used for discussion purposes and instructions on how to construct a histogram. (Students need to decide how to label their intervals on the graph. They

should discover that the data involved will determine the size of each interval.)

3.0 CLASS PROJECT: DATA COLLECTION & DISPLAY TECHNIQUE

Time allotted: Three or four class periods plus homework Discuss some simple ideas that students can begin to pursue with classmates. Students often begin with simple survey questions concerning “favorite”, e.g. What is your favorite type of sneakers? It is desired that they start with simple topics. The objective is for the students to learn data collection and display of that data. Certain skills are presumed to be held by the students. If the student does not possess these prerequisites, they should be taught first. The following activities require the following skills: knowledge of fractions, division involving decimals, finding percentages, rounding, general knowledge in the use of protractors and compasses.

Build a list on the blackboard that includes students’ suggested topics. Each student should have one of his/her own. Ex: “What is your favorite automobile?”

Have students construct a data collection sheet similar to the one shown. They should begin data collection as soon as they have finished constructing the data collection sheet. They will certainly have to finish outside of class. Collection is facilitated for this lesson by students verbally asking the question.

(figure available in print form)
(Tally marks are used in the column next to responses. Note that students put a tally mark after first recording one particular response.)

Upon completion of collecting the raw data, discuss some display methods one may use (histogram. pictograph, “pie” graph).

For the purposes of this lesson we will employ the pie graph method. This method is a personal favorite of mine because it requires the use of a number of math subskills.

Before actually constructing the pie graph students will have to properly fill in the next three columns on the data collection sheet.

-Fraction column The count becomes the numerator of the fraction. The denominator is the total number who were surveyed.
-Decimal column Dividing the denominator into the numerator yields a decimal fraction. If This decimal is taken to the thousandths place.
-Percent column Students can round the decimal column to the nearest hundredth. Dropping the decimal point and adding the percent sign produces the percent figures.
-Degrees column Multiplying the decimal column figures by 360 (number of degrees in a circle) yields the size of each “slice” of the pie graph. Students should round to the nearest whole degree. Note that the total number of degrees may add up to more than 360 due to rounding.

Construct the pie graph using the information they compiled on their data collection sheets.

Present results of individual surveys to entire class.

It is recognized that this lesson will require more time than the normal class period. While some of this may be completed outside of class, students will need close supervision by the teacher. Two class periods with homework assigned may be enough time.

(figure available in print form)

Try to engage students in a discussion of the relationships of the numbers they see in this chart. Can they discover that a fraction that is twice another fraction yields numbers that are twice as large in the remaining columns, i.e. 1/26 as compared to 2/26. Can they understand the relationship between fractions, decimals and percentages? There is much to be gleaned from this lesson if the time is put into it.

4.0 CLASS PROJECT: Leisure Time Activities

Time allotted: Two class periods plus homework We are now going to conduct a study of what your classmates like to do during their leisure time. On the list given to you are to "prioritized" the activities mentioned, giving a "1" to what you like to do best, "2" to your second choice, etc.

Collect data in class. Have students copy down the priority numbers that you read to them off of the students' questionnaires. Their homework assignment is to find the mean value for each activity.

4.1 Discussion of homework findings

Time allotted: one class period First see that everyone agrees on the means for each activity. No doubt there will be discrepancies. Clear these up as you go along. The priority values will likely be in decimal form, making it an added challenge for students to put the means in order. The lowest value is the activity that the class has as a priority leisure activity. Have students to compare their own priority values to those of the class.

(an alternative method is to use small groups calculate the means)

5.0 CLASS PROJECT: Survey on clique formation

Time allotted: Two class periods In the early sixties James Coleman asked a number of high school students the following question, "What does it take to get into the leading crowd in your school?" It would be interesting to find out how your students would rank the following areas:

WHAT DOES IT TAKE TO GET INTO THE LEADING CROWD

IN YOUR SCHOOL?

__ personality

__ be an athlete

__ good grades

__ good looks

__ have money

__ good clothes

__ come from right neighborhood

5.1 Collect data from 5.0. Calculate mean of each. Order list

Time allotted: one class period See lessons 4.0 & 4.1

CULMINATING ACTIVITY

A large investment of time has already occurred for the teacher who has done everything suggested thus far. Hopefully, a substantial return on this investment will be realized by the students gaining the proficiency required to do everything in the lessons. Another large investment of time will be required for students to go on to a study that seeks to find out what students do with their time, with whom, and how they feel during the course of a full week. We will not, for obvious reasons, be able to conduct a study as extensive as the Chicago study. For practical reasons we will set up a system of randomly "signaling" students that involves the students themselves. The questionnaire forms are not included in this unit because of copyright considerations. An ample number of questionnaires are available at the Yale-New Haven Teachers Institute office, 53 Wall St. One needs only to call and request the desired number of copies. There is much to be gleaned from this study. The data can be analyzed in much the same way as we did in the lessons above (those items which *can* be quantified). Certainly the students and you will learn more about what they are about. If you decide to do it, assure students that the results will not go any further than their own classroom.

BIBLIOGRAPHY

Csikszentmihalyi, Mihaly & Larson, Reed, *Being Adolescent: Conflict* and Growth in the Teenage Years, New York: Basic Books, 1984

This is the book about the study of adolescents in a Chicago suburb. The narrative of this unit refers to this book on a number of occasions. It is recommended for reading by any teacher who wishes to understand more about adolescents in modern America. The book is easily read and contains an enormous mass of data from the study.

Runyon, Richard P., & Haber, Audrey, *Fundamentals of Behavioral Statistics* , 5th ed., Reading, MA, Addison-Wesley, 1984

This is a basic textbook on statistics. The first five chapters is all the teacher would need to read in order to carry out the spirit of the lessons in this unit. The book would certainly come in handy for anyone who plans to take a statistics course in graduate school.

Steinberg, Laurence, *Adolescence* , New York: Alfred A. Knopf, 1985

This book is also cited extensively in the narrative of this unit. The book provides an excellent framework for studying and understanding adolescence as a part of the total life. It is an excellent book that would be a fine addition to any teacher's library.

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