

Course
Statistics and Probability

MTH-1102-3

Secondary Cycle One



“It is one of humanity’s habits to use thought where nature left things to chance.”

Jérôme Touzalin

Presentation of the Course *Statistics and Probability*

The course *Statistics and Probability* is designed to help adult learners deal competently with real-life situations where they must solve problems that require them to predict random events.

It prepares adult learners to use their knowledge of statistics and probability to study random phenomena and to profile past or present random events with a view to predicting others.

The course builds on the knowledge acquired in the presecondary course entitled *Sets and Statistics*, where adult learners became familiar with the use of statistics and sets to deal with relatively familiar real-life situations in which information was always easily available. The *Statistics and Probability* course allows them to expand their knowledge in this regard. They will not only process data (classifying, interpreting and representing it), but also collect and analyze it with a view to making predictions. They learn about data collection (sample survey, census and study), sources of bias and other statistical representation methods, namely relative frequency tables, broken-line graphs and circle graphs. Statistics provide an overview of random phenomena and can be used to calculate the probability that a given event will occur. Conversely, calculating probability makes it possible to predict statistical outcomes to some extent. These two areas of mathematics are

used together to deal with many real-life situations in which adult learners must make informed choices based on their predictions of random events. In this course, they will become familiar with a number of new concepts: enumeration, theoretical probability, experimental probability and the various types of events (e.g. probable, certain, impossible, dependent, complementary).

By the end of the course, adult learners will be able to produce statistical distributions (e.g. inventories, sample survey results, academic results, studies of endangered animal species) by collecting data. They will also be able to interpret the results of their data collection as well as statistical distributions produced by other people and organizations. To evaluate the chances that a random event will occur, they will be able to calculate the experimental probability, using statistical data, or to calculate the theoretical probability using simple techniques. They will also use the mathematical language pertaining to statistical representation methods and probability, and will make deductions and inferences based mainly on the logic of sets and probabilities. Lastly, they will have a discerning and objective view of the many statistical and probability forecasts published in the media.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.



Class of Situations Addressed by the Course

This course addresses a single class of situations: *Predicting random events*.

The real-life situations in this class involve predicting certain random events that may occur. To be able to do this, adult learners must develop a general view of random phenomena or experiments, which they acquire by working with statistical and probabilistic representations. The real-life situations addressed in the course are selected for their diversity and significance to adults, rather than for their complexity.

Some of the real-life situations in this class involve social concerns, which are more easily observed using statistical or probabilistic representations. This is the case, for example, when adult learners analyze a sample survey in order to predict the outcome of an

election or when they examine the placement rate for graduates in a given field so that they can decide on an occupation. Other real-life situations involve natural phenomena, for example when adult learners examine the weather forecasts to predict the possibility of rain on an outdoor activity day or when they calculate their chances of having three successive children of the same gender. Lastly, this class also includes real-life situations where adults take part in random experiments, such as buying raffle tickets, playing a game of chance or identifying a padlock combination by trial and error.

Class of Situations	Examples of Real-Life Situations
Predicting random events	<ul style="list-style-type: none"> ▪ Taking part in an election ▪ Planning a family budget ▪ Launching a food service at the centre ▪ Studying endangered animal species ▪ Studying natural disasters ▪ Analyzing the student groups in an education centre or the clientele of a business ▪ Collecting food donations for a charity ▪ Taking a position on a social issue ▪ Selecting a career ▪ Planning an outdoor activity ▪ Assessing the risk of an accident ▪ Purchasing insurance coverage

Class of Situations	Examples of Real-Life Situations
	<ul style="list-style-type: none">▪ Taking part in a hockey pool▪ Taking part in a simple game of chance▪ Taking part in a raffle▪ Planning a family

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
<ul style="list-style-type: none"> ▪ Producing statistical distributions 	<ul style="list-style-type: none"> ▪ Uses a broken-line graph to represent changes in voting intentions during the weeks preceding an election ▪ Consults specialists as part of a study on endangered animal species ▪ Produces a sample survey to determine the extent to which neighbourhood residents are interested in having a new park ▪ Collects information on precipitation levels in January ▪ Prepares an inventory of products collected for a food drive ▪ Uses a circle graph to illustrate Québec's various employment sectors
<ul style="list-style-type: none"> ▪ Interpreting statistical distributions 	<ul style="list-style-type: none"> ▪ Describes changes in voting intentions on the basis of a broken-line graph ▪ Determines the placement rate for graduates in a given occupation ▪ Identifies the hockey players who performed well offensively throughout the season ▪ Identifies the most popular brand of running shoes among young people on the basis of a bar graph ▪ Becomes familiar with soil contamination levels by studying a circle graph ▪ Determines the average winter temperature in Québec ▪ Determines the age difference between the youngest student and oldest student in the class

Categories of Actions	Examples of Actions
<ul style="list-style-type: none">▪ Determining the probability that a random event will occur	<ul style="list-style-type: none">▪ Determines the probability that a particular candidate will win the next election▪ Determines the probability that an earthquake will occur in the region▪ Determines the probability of snow showers by listening to a weather forecast▪ Determines the most probable outcome of a game of chance▪ Compares the probability of dying in a car accident when wearing and not wearing a seat belt▪ Estimates the chances of winning a draw▪ Calculates the probability of having three successive children of the same gender▪ Calculates the probability of randomly finding the correct combination for a padlock

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Predicting random events

Categories of Actions

- Producing statistical distributions
- Interpreting statistical distributions
- Determining the probability that a random event will occur

Operational Competencies

Thinks logically

- Infers the characteristics shared by several data values
- Infers the multiplication techniques required to determine the possible outcomes and the probabilities
- Deduces implicit information
- Decides whether two random events are complementary, compatible or dependent
- Makes sure his/her conclusions are plausible and consistent

Communicates

- Accurately decodes symbols, notations and terms pertaining to statistics and probabilities
- Identifies explicit information that can be used to give meaning to the data
- Structures the message properly using appropriate methods of representation
- Rigorously uses the symbols, notations and terms pertaining to statistics and probabilities
- Ensures that the message is clear

Exercises critical and ethical judgment

- Checks the credibility of information sources
- Identifies sources of bias that may influence data collection results
- Identifies factors that may influence probability predictions
- Forms an opinion or makes choices based on facts or objective data
- Minimizes sources of bias when collecting data

Essential Knowledge

- Data collection
- Statistical distributions
- Probability
- Sets
- Arithmetic

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes

In order to deal with situations in the class *Predicting random events*, adult learners produce and interpret statistical distributions and determine the probability that certain random events will occur.

Adult learners produce statistical distributions in different contexts, for example when assessing their educational performance, surveying fellow students to determine their interest in having a food service at the centre, testing a theoretical model by conducting an experiment that involves rolling two dice, and so on. To do this, they must choose the most appropriate type of data collection method for the situation and carefully select their data sources. If they are required to produce a data collection form for a census, sample survey or study, they make sure the questions are worded clearly and unambiguously. They try to minimize sources of bias by ensuring that the survey sample or, in the case of a random experiment, the number of trials is representative. They convey the outcome of the data collection process using an appropriate, correctly structured statistical representation method. They infer the characteristics that are common to the data in order to decide which quantified items will appear in their table or graph. They make proper use of the symbols, notations and terms pertaining to statistics and probabilities, correctly identify a legend or sample space, and graduate the axes for a broken-line graph. They also ensure that their message is clear and understood by the target audience.

Adult learners interpret statistical distributions when they examine the results of sample surveys and studies, weather forecasts, sports predictions and so on. This involves accurately decoding the symbols, notations and terms pertaining to statistics and probabilities. They also recognize the terms pertaining to data collection. They identify explicit information, such as the titles of representations, and deduce implicit information, such as the mean, in order to determine the meaning of the data. They select the operations required to calculate the mean when dealing with variables, frequencies or relative frequencies. Throughout the process, they check the information by comparing different sources, where possible, and by checking the credibility of the individuals or institutions concerned. They detect any sources of bias that may influence the data collection results. They are also wary of invitations to take part in games of chance, since they know that the probability of losing is generally much greater than the probability of winning. They form opinions and make choices based on facts or objective data.

Adult learners determine the experimental probability that a random event will occur by making connections between the data from a statistical distribution. After studying possible events, they are able to deduce whether a given event is impossible, probable or certain. They make connections between two random events to see whether they are complementary, compatible or dependent. They can also predict their chances of experiencing a specific event and make rational decisions based on statistical data relating to social and natural phenomena. They identify the factors that may influence their probabilistic forecasts, such as changes that have occurred since the data were collected. To

calculate theoretical probability, they use representations of possible outcomes and favourable outcomes. For example, they can identify the various possible outcomes of a two-dice game by using a tree diagram. They use inferred multiplication techniques to calculate the exact number of possible outcomes and favourable outcomes for a given event, or the probability that the event will occur. They then check the plausibility and consistency of their conclusions (e.g. calculations, predictions, representations, choices).

Evaluation Criteria

- Produces clear and accurate statistical distributions
- Interprets statistical distributions correctly
- Accurately determines the probability of a random event occurring

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically*, *Communicate*, and *Exercises critical and ethical judgment*.

Contribution of the Operational Competency *Thinks logically*

The operational competency *Thinks logically* helps adult learners to make connections and draw conclusions when dealing with real-life situations related to the class *Predicting random events*. It involves making deductions and inferences that, in this course, are based mainly on the logic of sets and probabilities.

Adult learners think logically when they infer the characteristics common to various data values in order to identify the quantified objects in a table or graph, for example. They establish disjoint subsets to avoid overlapping sets of quantified objects. They can also infer the multiplication technique required to calculate the number of possible or favourable outcomes for an experiment divided into several steps. They can also use generalization to decide that the probability of a given outcome may be obtained by multiplying the probabilities of a favourable outcome at each step. They look for examples to verify their conjectures, or counterexamples to clarify, adjust or refute them.

Adult learners make connections between the various data values. In doing so, they are able to interpret and classify the data in order to study a natural phenomenon, analyze a social issue, predict a specific event, and so on. They also deduce implicit information in the statistical or probabilistic representations they must interpret. For example, they can deduce whether a given event is impossible, probable or certain, and select the operations required to calculate the range or the mean when dealing with variables, frequencies or relative frequencies. They also deduce the most appropriate data collection method (sample survey, census or study) for the situation and make connections between the data from different statistical distributions to determine experimental probabilities. They can predict their chances of experiencing a given event and make rational decisions based on statistical data pertaining to social and natural phenomena. They can also make connections between two random events to see whether they are complementary, compatible or dependent. They then check the plausibility and consistency of their conclusions (e.g. calculations, predictions, representations, choices).

Contribution of the Operational Competency *Communicate*

The operational competency *Communicates* allows adult learners to interpret and produce messages that include statistics and probabilities when they deal with real-life situations related to the class *Predicting random events*. It involves decoding and making appropriate use of mathematical language pertaining to statistics and the different kinds of probabilities.

When interpreting messages, adult learners accurately decode the symbols, notations and terms pertaining to statistical and probabilistic representations (e.g. tables, circle graphs, broken-line graphs, tree diagrams, networks). They also recognize data collection terms (e.g. census, population, sample) and probability terms (e.g. random phenomenon, favourable outcome, equiprobable outcomes, probable event, certain event, dependent event). Among other things, they interpret sample surveys, media information, weather forecasts or information on games of chance by identifying the explicit information (e.g. titles of statistical representations or the scale used to graduate the axes for a graph) required to determine the meaning of the data. If in doubt, they ensure that their interpretation is accurate by consulting other people.

When producing messages, adult learners make appropriate use of the symbols, notations and terms pertaining to statistics and probabilities. They structure the message appropriately by using representation methods that are appropriate to the real-life situation. They correctly identify legends, graduate the axes for broken-line graphs, and list the set of possible and favourable outcomes. For example, they may use a broken-line graph to illustrate their academic results over time, or a tree diagram to illustrate the different possible outcomes of a dice game. They ensure that their message is clear and understood by the target audience. When collecting data, they must ensure that their questions are worded properly to avoid ambiguity.

Contribution of the Operational Competency *Exercises critical and ethical judgment*

The operational competency *Exercises critical and ethical judgment* enables adult learners to make judgments and informed decisions when dealing with real-life situations belonging to the class *Predicting random events*. It allows them to be objective and discerning with respect to statistical and probabilistic predictions.

Adult learners use their critical and ethical judgment when they analyze the results of sample surveys or studies, weather forecasts, sports predictions and so on. It is important that they be careful when considering this type of information. Adult learners assess the validity of the information that is presented by comparing different sources, where possible, and by checking the credibility of the people or institutions that provided it. They identify sources of bias that may influence the results of the data collection process, along with the factors that may influence probabilistic predictions, such as changes that have occurred since the data were collected. They learn that the data displayed in a given statistical representation and any related comments may be dictated by the personal opinions and interests of those who produced it. Learners are also wary of invitations to take part in games of chance, since they know that the probability of losing is generally much greater than the probability of winning. They must therefore exercise discernment when forming an opinion or making choices based on facts or objective data.

When producing statistical distributions, adult learners select their data sources carefully and try to be objective. They take care to minimize sources of potential bias so as not to taint their data collection results. They avoid giving a thoughtless and unfounded personal opinion. Similarly, when determining experimental probability from a random experiment, they perform a sufficient number of trials to obtain a representative outcome.

Essential Knowledge

All of the knowledge shown in the table below is compulsory since it is essential for dealing with many of the situations in the class *Predicting random events*.

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since previously acquired knowledge is also needed to deal with the situations examined in this course, adult learners must deepen their understanding of this knowledge by adapting it to situations that involve predicting random events.

Since essential knowledge pertaining to arithmetic is dealt with only in a context involving the prediction of random events, this material is covered only in a partial manner. In order that every facet of this essential knowledge may be dealt with in a broader range of contexts, it has been made compulsory in other mathematics courses that examine other types of situations.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
<p>Data collection</p> <ul style="list-style-type: none"> • Population • Representative sample • Sample survey, census and study • Sources of bias • Sampling methods (random and systematic) • Creating data collection forms • Establishing a representative sample or defining a population • Collecting data <p>Statistical distributions</p> <ul style="list-style-type: none"> • Data (continuous quantitative) • Maximum, minimum, range 	<p>Sets</p> <ul style="list-style-type: none"> • Sets and subsets • Membership, inclusion and exclusion relationships • Classifying elements using sets and subsets • Representing sets and subsets by listing their elements and using a Venn diagram • Reading representations involving sets and subsets (Venn diagrams, representations using words, and representations using lists of elements) <p>Statistical distributions</p> <ul style="list-style-type: none"> • Discrete quantitative data or qualitative data • Axes • Legend

New compulsory knowledge	Compulsory knowledge acquired in previous courses
<p>Statistical distributions (cont'd)</p> <ul style="list-style-type: none"> • Reading statistical representations (relative frequency tables, broken-line graphs and circle graphs) • Constructing relative frequency tables • Graphing statistical distributions (broken-line and circle graphs) • Determining the mode of a statistical distribution involving qualitative data • Calculating the mean using frequencies or relative frequencies from a statistical distribution <p>Probability</p> <ul style="list-style-type: none"> • Chance • Random experiment • Event • Equiprobable and non equiprobable events • Sample space • Favourable outcomes • Theoretical probability and experimental probability • Determining experimental probability • Calculating theoretical probability • Probable, certain and impossible events • Relationship between two events (dependent, independent, complementary, compatible, incompatible) • Calculating the number of possible outcomes and the number of favourable outcomes • Enumeration for an experiment involving no more than three steps, using representation methods (grids, tables, tree diagrams, networks etc. 	<p>Statistical distributions (cont'd)</p> <ul style="list-style-type: none"> • Mean • Reading statistical representations (tables of variables, frequency tables, bar graphs and pictographs) • Constructing tables of variables and frequency tables • Graphing statistical distributions (bar graphs and pictographs) • Calculating the mean using the data from statistical distributions (it must be possible to perform the calculation simply by adding up the data values and dividing by the number of values) <p>Arithmetic</p> <ul style="list-style-type: none"> • Converting rational numbers from one form of notation to another (fractions, decimals and percentages) • Rounding off positive decimals • Solving sequences of arithmetic operations on rational numbers • Making a mental estimate of the results of operations or sequences of operations on rational numbers • Representing relationships using arithmetic models consisting of rational numbers • Positioning decimals on the number line

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Rigour	Vigilance
<p>Adult learners with this attitude are precise and methodical when collecting data, producing representations or determining probability. As a result, their predictions are likely to be more realistic and easier for other people to understand.</p>	<p>Adult learners with this attitude are critical and wary of statistics and related analyses, and of common beliefs about games of chance and lotteries.</p>
Curiosity	
<p>Adults with this attitude want to know more about their surroundings, meaning that they are more interested in predicting random events of all kinds, regardless of whether these predictions are based on the analysis of past events, experiments or theoretical calculations.</p>	

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
<ul style="list-style-type: none">▪ Statistics Canada▪ Institut de la statistique du Québec▪ Emploi Québec▪ Environment Canada▪ Community associations▪ Environmental organizations	<ul style="list-style-type: none">▪ Calculator▪ Ruler▪ Spreadsheets▪ Newspapers▪ Magazines▪ Government publications▪ Electronic media▪ Games of chance (e.g. dice, cards, lottery drum)▪ Lottery tickets▪ Web sites

Contribution of the Subject Areas

The contribution of other subject areas, in particular knowledge related to the Social Sciences, Working Life, Personal Development, Languages and Mathematics, Science and Technology is also useful for dealing with the real-life situations in this course. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Subject Area: Social Sciences

Programs of Study: *Social and Political Life, Community and Culture and Consumer Habits*

- When adult learners produce or interpret statistical representations, they may use their knowledge of politics, the economy, advertising and so on. Similarly, when dealing with real-life situations involving games of chance such as lotteries, cards or slot machines, adults may use their knowledge of consumer behaviour, consumer vigilance, debt prevention, consumer incentives and so on.

Subject Area: Working Life

Program of Study: *Introduction to the World of Work and Career Choice*

- Since some of the real-life situations examined in this course involve the world of work and career choices, adult learners may be required to use what they know about trades and occupations, business organization, etc.

Subject Area: Personal Development

Program of Study: *Health*

- Adult learners use their health-related knowledge when studying statistics and probabilities, for example to anticipate the health effects of smoking, obesity or anorexia.

Subject Area: Languages

Program of Study: *English, Language of Instruction*

- All the situations in this course are likely to require adult learners to communicate orally and in writing. Consequently, the language of instruction will be used throughout the course.

Subject Area: Mathematics, Science and Technology

Program of Study: *Computer Science*

- Some of the real-life situations in this course could involve the use of computer resources. For example, adult learners may be required to use spreadsheets to produce statistical representations, or word processing applications to prepare data collection questionnaires. Lastly, it is much easier to search for information using electronic media.

Program of Study: *Relationship With the Environment*

- Knowledge of natural phenomena such as earthquakes, floods and rain or snow showers may also be useful in this course.

Program of Study: *Mathematics*

- In addition to the knowledge that is compulsory for the *Statistics and Probability* course, working with some of the real-life situations may require knowledge of the mathematical content covered in other courses in the Common Core Basic Education Program. This will be the case, for instance, if adult learners use comparative bar graphs or histograms.

Andragogical Context

Situations that involve statistics and probabilities are common in the every day lives of adult learners, whether they are choosing an occupation or educational program, taking part in an election or a game of chance, or adopting a position on an environmental issue. Situations involving social concerns are particularly appropriate for this course, since they involve inventories, sample surveys, studies and probabilities of all kinds.

The teacher draws on the real-life experience of learners in order to present them with plausible learning situations. The closer the learning situations are to actual everyday situations, the more meaningful they are and the more knowledge the students will retain. Predictions should also relate to subjects of interest to the adult learners. The teacher should concentrate on providing a range of learning situations, rather than emphasizing their complexity. The purpose of the course is not to study advanced calculation techniques, but rather to help learners develop rational thinking skills so that they can make informed choices and anticipate events.

Adult learners are seldom required to collect data or produce statistical or probabilistic representations in their everyday lives. In a learning situation, the purpose of this type of exercise is mainly to help them develop a sense of set logic and better understand how to present data in such a way that it is easier to interpret. By collecting the data themselves—a process that involves forming a representative sample and minimizing sources of bias—adult learners will realize that studies and sample surveys may not always be carried out objectively. This will make them aware of the importance of being wary of statistics published in the media and teach them to identify sources of bias. The task of producing

statistical distributions should therefore be approached from the standpoint of improving their interpretation abilities.

Set theory is a prerequisite to producing statistical representations, since it involves dividing data into disjoint sets and subsets. This type of classification is necessary if the statistical representation is to be unequivocal. Some of the proposed learning situations may combine set theory and statistical representations so that learners will be aware of the connection between the two. Adult learners from the youth sector who have not taken presecondary courses at an adult education centre will not yet have studied sets. The teacher must therefore devote time to this topic and devise learning situations to fill any gaps in their learning. The course also continues to build on learners' arithmetic knowledge. Although percentages have already been studied beforehand, they are incorporated into all the learning situations covered by the course. Teachers should therefore take advantage of the opportunity to consolidate learners' knowledge of percentages.

This course should enable adult learners to appreciate both the usefulness and limitations of statistics and probabilities when it comes to predicting random events. Predictions are based on estimates of the chance that the event will actually occur, and not on absolute certainties. Predictions based solely on statistical data—in other words, on past or present events—do not take all the factors into account. Adult learners must also consider that predictions based on theoretical probability calculations are accurate only if a sufficient number of outcomes are used in the calculation.

In a society where adults are increasingly encouraged to purchase all kinds of lottery tickets, this course provides an excellent opportunity to examine the problems pertaining to games of chance and draws. However, because some adults may already be compulsive gamblers, the teacher should be careful when addressing this topic and therefore give priority to group discussions on the myths and realities of games of chance and lotteries.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

Career Choice Predictions

The real-life situation chosen for the class *Predicting random events* involves selecting a career. In the related learning situation, adult learners are invited to explore a trade or occupation of interest to them by using statistics and probabilities, and to present their results to the group.

The teacher begins by presenting a video or text describing the experience of a person who has chosen a career that did not really meet his/her aspirations. This is followed by a group discussion on the most important information to be considered before making a choice, such as placement rates, salary levels, the location of employer companies, the size of companies in the field, and so on. The teacher helps adult learners realize that the chances of obtaining the desired position or salary can be estimated through predictions based on statistics and probabilities.

Adult learners are then invited to indicate which careers they are considering and to select one that is of particular interest to them. The teacher presents three data values that adult learners must predict for that trade or occupation, namely the evolution of the mean starting salary, concentration of jobs by region and graduate placement rates.

The learning activity involves searching for information related to this data on the Web, in employment guides and from other sources. The information may sometimes be presented in tables of variables or frequency tables, meaning that adults must use their prior knowledge in this regard. The teacher begins by making sure the adults have properly constructed this knowledge by handing out a

short questionnaire. If some learners do not appear to have the necessary knowledge, the teacher should pay particular attention to them as they search for information, providing the support they need and encouraging them to help one another. Adult learners then compile the information on the mean starting salary in a table of variables, and the information on job concentration by region and graduate placement rates in frequency tables.

Adult learners then construct knowledge of relative frequency tables. The teacher asks them to calculate the percentages for each value. They should be able to do this because they have already calculated percentages in other learning contexts. It should be noted that some statistical distributions compiled during the information search might actually show relative frequencies.

The next learning activity is designed to help adults construct their knowledge of two types of graphs. First, adults use a broken-line graph to show changes in the mean starting salary and placement rate. Second, they use a circle graph to show job concentration by region, although a pictograph or bar graph would be equally appropriate. The teacher asks learners to form “expert teams” to carry out a task that will help them become more proficient at drawing these graphs and develops two separate kits for that purpose. The first kit contains explanations and examples of how to draw a broken-line graph, and the second contains explanations and examples of how to draw a circle graph. The adults divide into groups of four, and the teacher hands out one kit to each team. The team members read the information in the kit, talk about it and make

sure they understand it by filling out a short questionnaire provided by the teacher. Each team is then split into groups of two, and these pairs form new teams of four composed of two members who have studied broken-line graphs and two who have examined circle graphs. Each pair of learners then explains its graph to the other pair of learners, and asks questions to ensure that they have understood the concepts involved.

Working individually, adult learners draw graphs showing changes in salaries and placement rates over the last five years, as well as the regions where jobs in their chosen trade or occupation are concentrated. Analyzing the broken-line graphs allows them to anticipate future changes in salaries and placement rates. To help them use a circle graph to determine the probability of finding a job in a given region, the teacher explains that relative frequencies are also experimental probabilities. Having understood the connection between experimental probabilities and relative frequencies, each adult analyzes his/her own circle graph to see whether the chances of finding a job in his/her region are good, and whether he/she is interested in working in the regions where the demand is greatest.

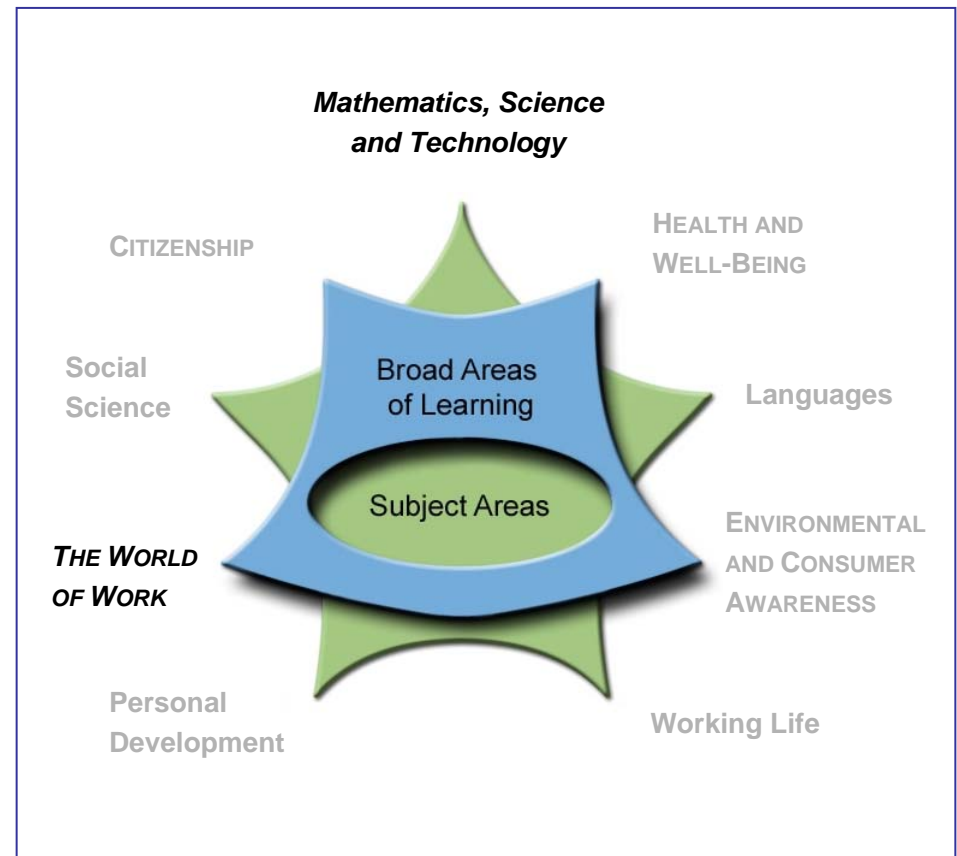
These graphs are used to illustrate the predictions relating to the chosen trade or occupation and to make a short oral presentation to the class. As they share their findings, adult learners are able to observe several different examples of the two types of graphs studied and to explore different trades and occupations, all of which should help them make an informed career choice. They ensure that their graphs are clear and in compliance with mathematical language codes. By launching a group discussion on ways in which information may be incorrectly interpreted or on possible sources of bias, the teacher encourages learners to critically examine the results presented. For instance, the class considers the possibility

that the published salary figures are not accurate due to black market work or insufficient data. The teacher also talks to adult learners about the reliability of their predictions and encourages them to exercise their critical judgment by having them identify factors that may alter their findings between now and the time they are ready to join the workforce (e.g. saturation of demand for labour, new company or government policies, company closures and mergers).

Lastly, the teacher and adult learners discuss the usefulness of the two types of graphs studied, with learners identifying the advantages and disadvantages of each. The teacher asks them to select the type of graph they would use for different statistical distributions and to justify their choice. During the discussion, bar charts and pictographs may also be considered, even though they were not used in the exercise.

Elements of the Course Addressed by the Learning Situation

Class of Situations	
Predicting random events	
Learning Situation	
Career Choice Predictions	
Categories of Actions	
<ul style="list-style-type: none"> Producing statistical distributions Interpreting statistical distributions Determining the probability that a random event will occur 	
Operational Competencies	Essential Knowledge
<ul style="list-style-type: none"> Thinks logically Communicates Exercises critical and ethical judgment 	<ul style="list-style-type: none"> Data Axes Legend Mean Reading statistical representations Constructing tables of variables and frequency tables Constructing relative frequency tables Graphing statistical distributions Determining the mode of a statistical distribution involving qualitative data Determining experimental probability Converting rational numbers from one form of notation to another



Complementary Resources

- Calculator
- Ruler or spreadsheet
- Employment guides
- Statistics Canada
- Internet