Using CTE Data Beyond Accountability: A Nebraska Example

Matt Hastings

Nebraska Department of Education

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Presentation Objectives

1. Understand the role of subpopulations in Perkins accountability data framework
2. Realize the challenges in relying solely on federal accountability analyses
3. Identify the value in adopting and utilizing a CTE data diversification strategy
4. Gain practical analytic suggestions for diversifying CTE data analysis

Its More than Numbers

- "If the quality of life is to be improved in this modern world, its citizens must understand how to make sense out of numbers."

– David A. Kenny

Statistics for the Social and Behavioral Sciences

Its More than Numbers

- Numbers are not important in and of themselves. (Kenny 1987)
- They are important because they help us make decisions. (Kenny 1987)
- Decisions can be made without numbers, but if the right numbers are used, in the right way, the quality of decisions can be improved. (Kenny 1987)

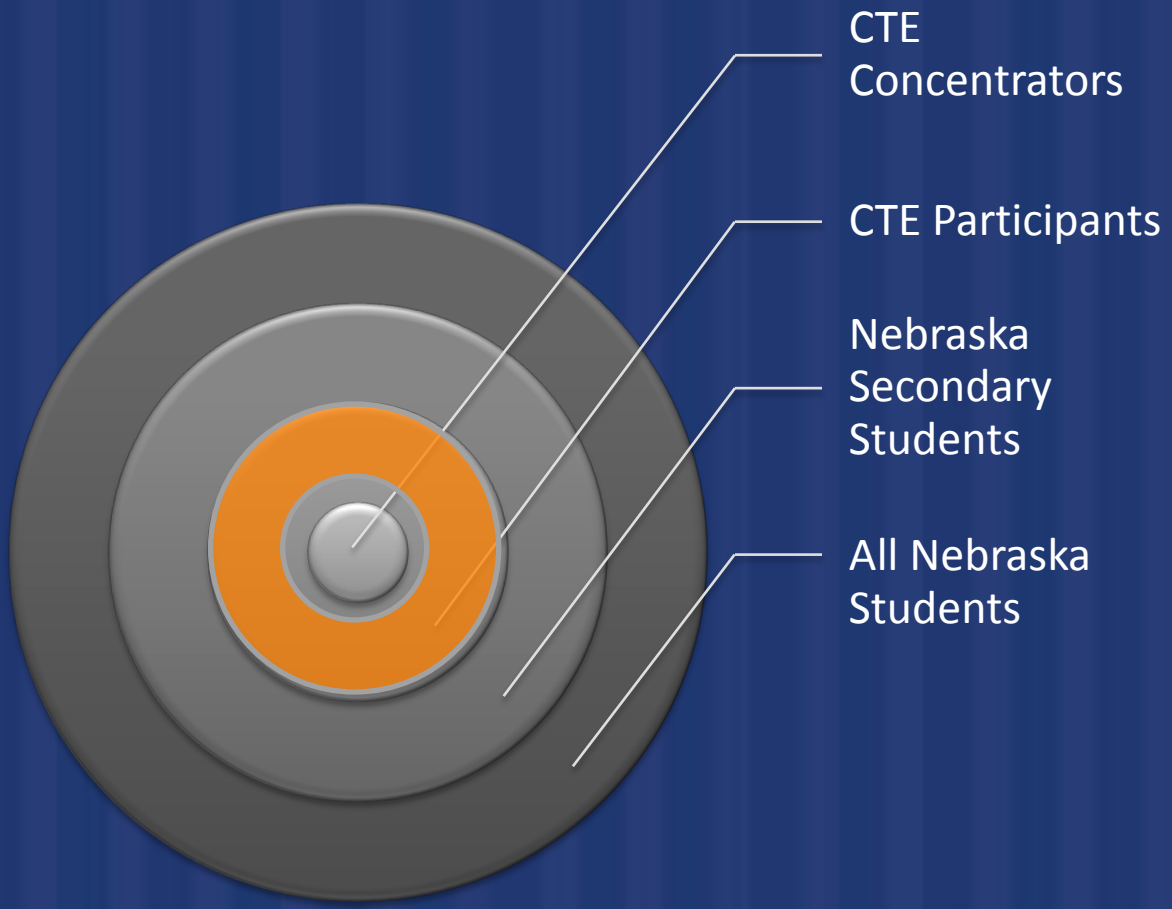
CTE Accountability Background

- 1990 Perkins Act required states to "develop accountability systems that include performance measures and standards for secondary and post-secondary vocational education programs." (Hoachlander, Levesque, & Rahn 1992)
- Later, iterations of Perkins sought to "assess the effectiveness of the state in achieving statewide progress in vocational and technical education and to optimize the return of investment of federal funds in vocational technical education activities." (sec. 113(a))

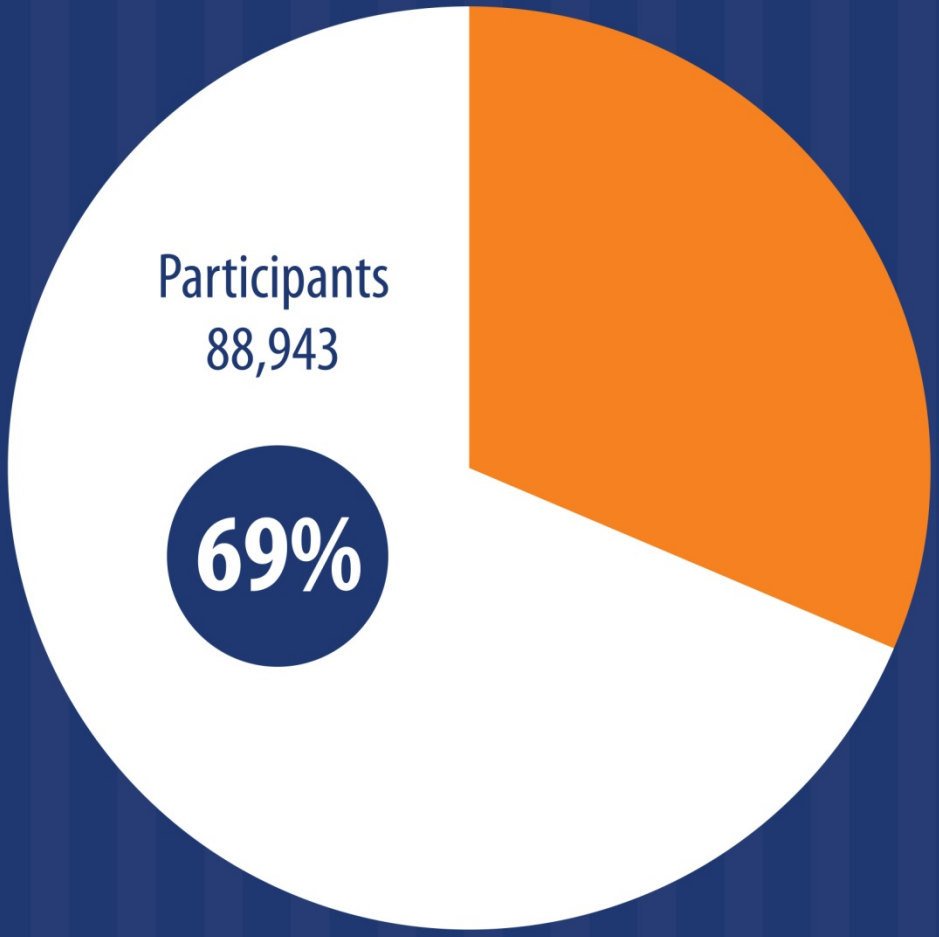
Perkins Vehicle for Accountability

- Consolidated Annual Report (CAR) Data identifies subpopulations of CTE students
  - Students that, presumably, receive some educational benefit from an investment of federal resources (or should)
    - *Carl D. Perkins Career and Technical Education Improvement Act of 2006 P.L. 109-270*
  - These subpopulations are translated into fractions and ultimately percentages which are compared against state performance goals (FAUPLs)

CAR Secondary Population-Subpopulation Schematic



2009-2010 Nebraska Career Education



Nebraska Fall Membership Grades 7-12

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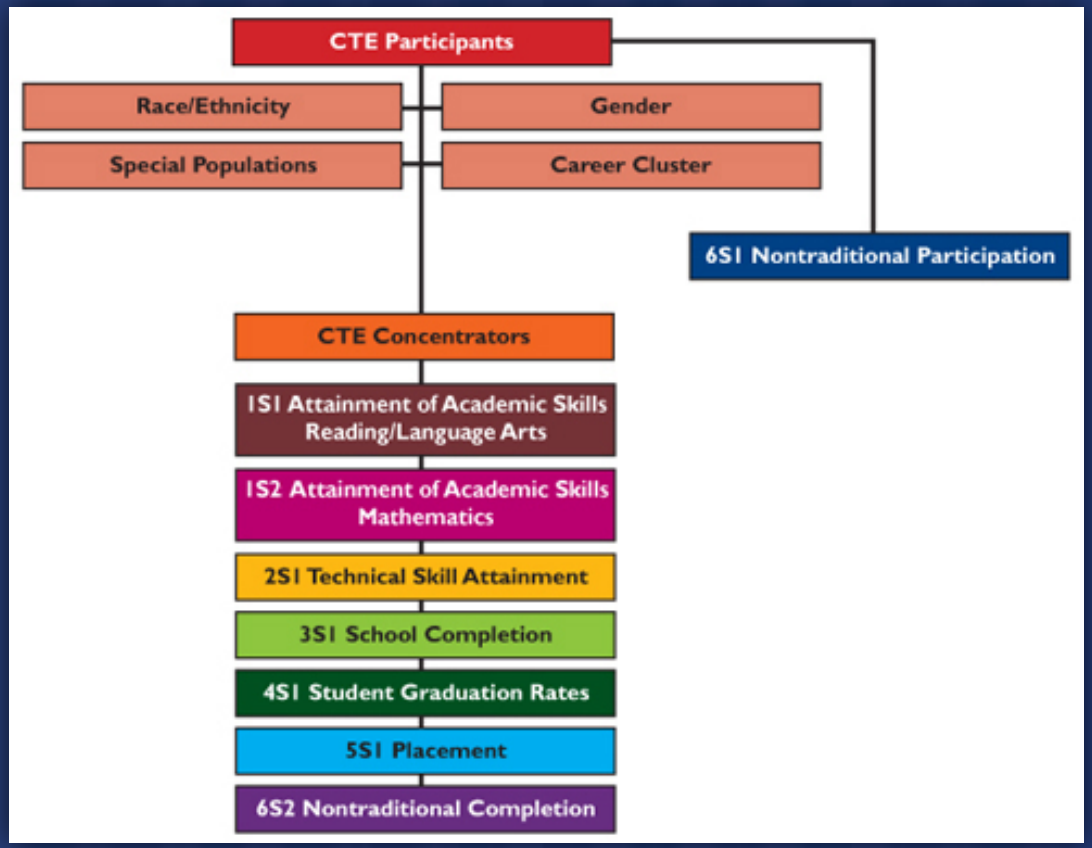
Perkins IV Secondary Accountability Performance Indicator Framework

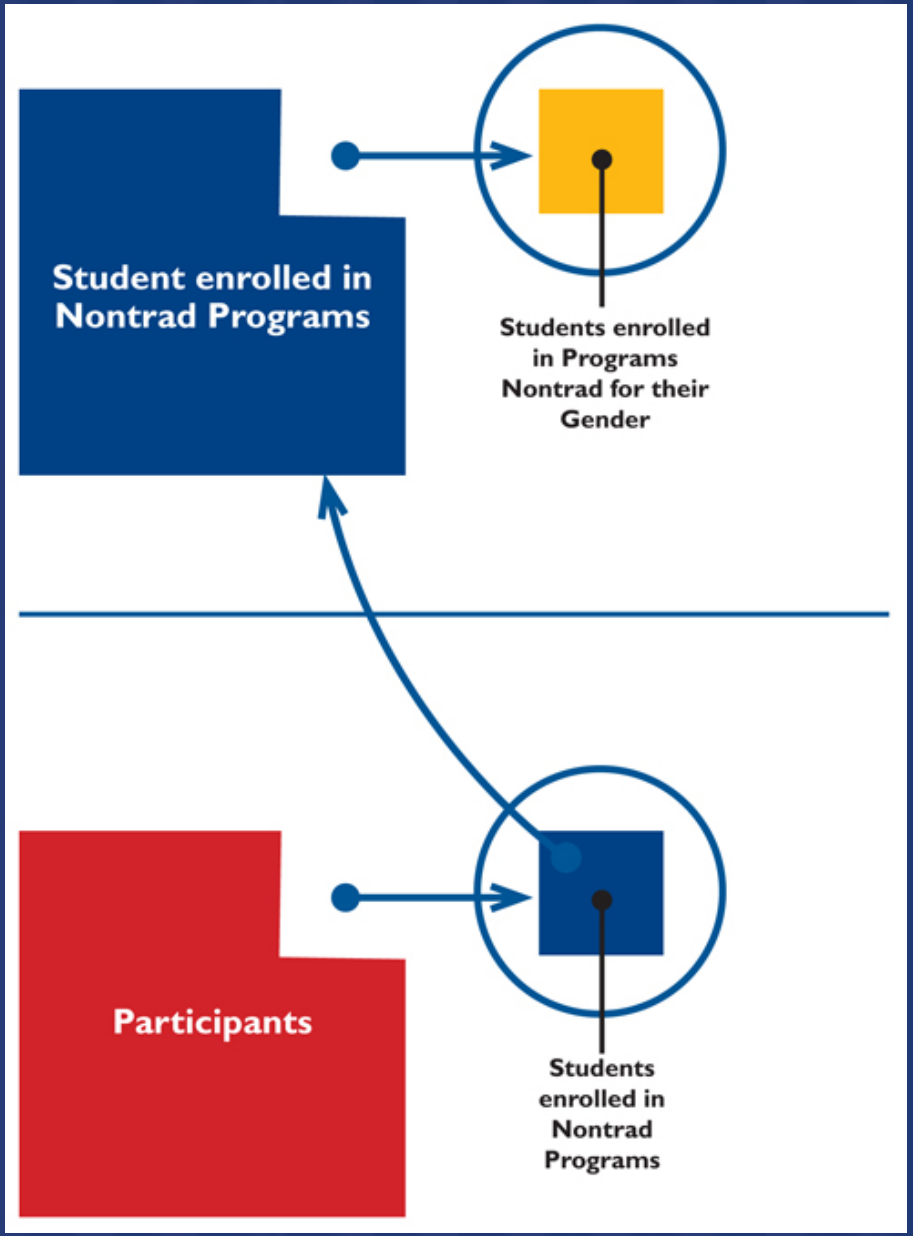
This graphic represents the relationship between the Perkins Secondary Performance Indicators and the CTE Participants and CTE Concentrators.



Fractions of Subpopulations (6S1)

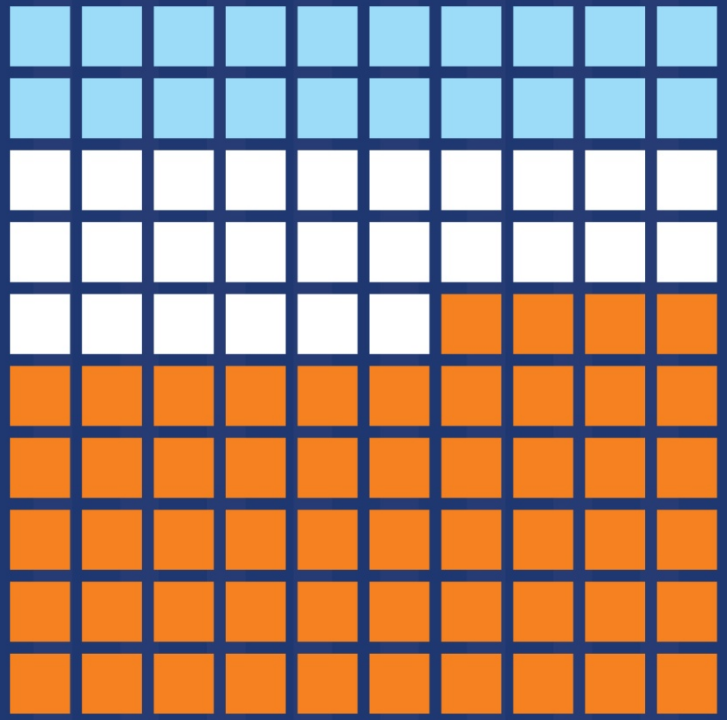
Numerator: Number of CTE participants from underrepresented gender groups who participated in a program that leads to employment in nontraditional fields during the reporting year.

Denominator: Number of CTE participants who participated in a program that leads to employment in nontraditional fields during the reporting year.



2009-2010 Nebraska Career Education

Grades 7-12



Total Membership: 129,759

Nebraska Fall Membership

6S1: Nontraditional Participation

6S1 Numerator

6S1 Denominator

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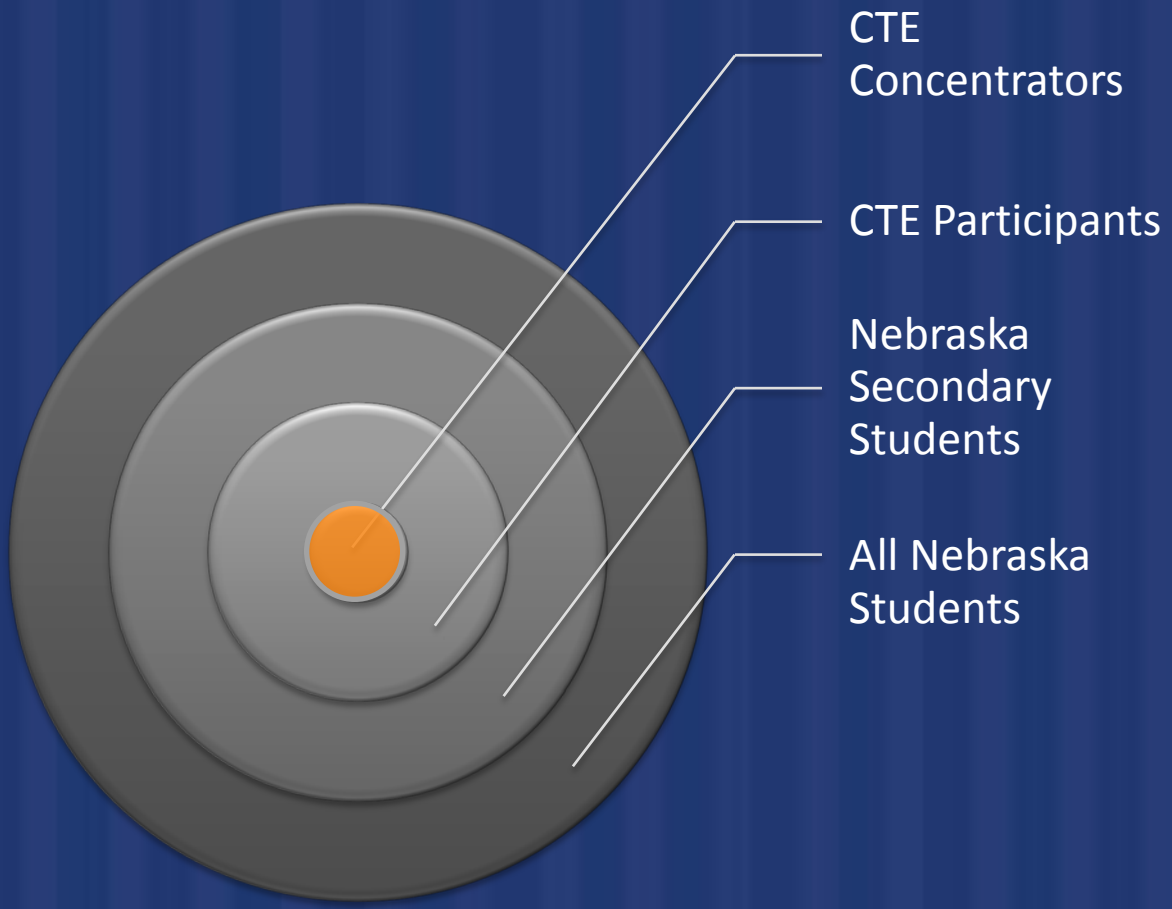
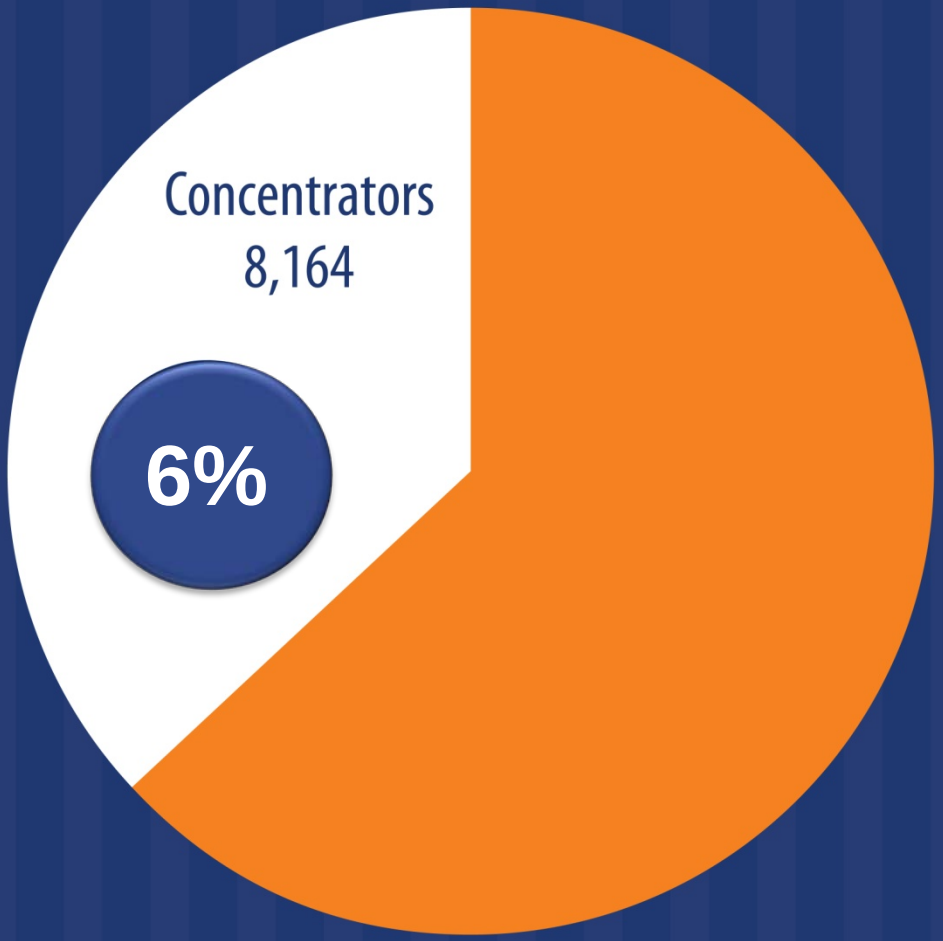
CAR Secondary Population-Subpopulation Schematic



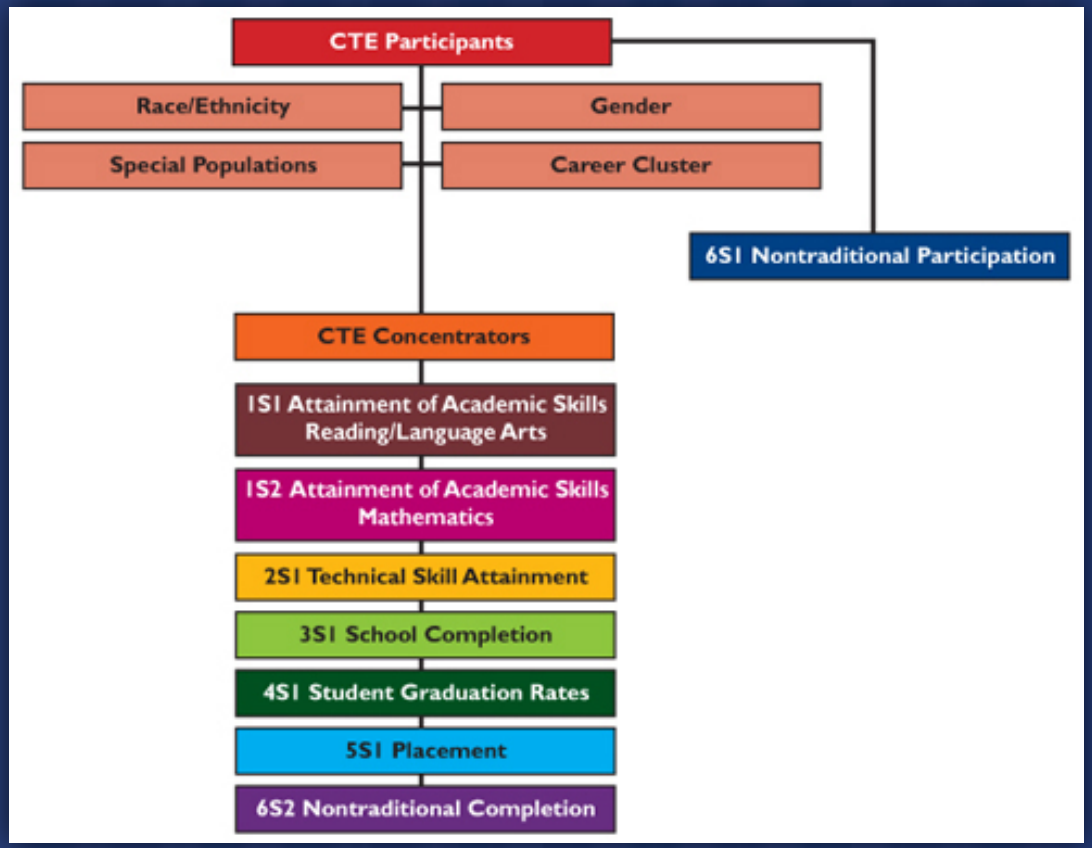


Total Membership
129,759

Nebraska Fall Membership 12th Grade

Perkins IV Secondary Accountability Performance Indicator Framework

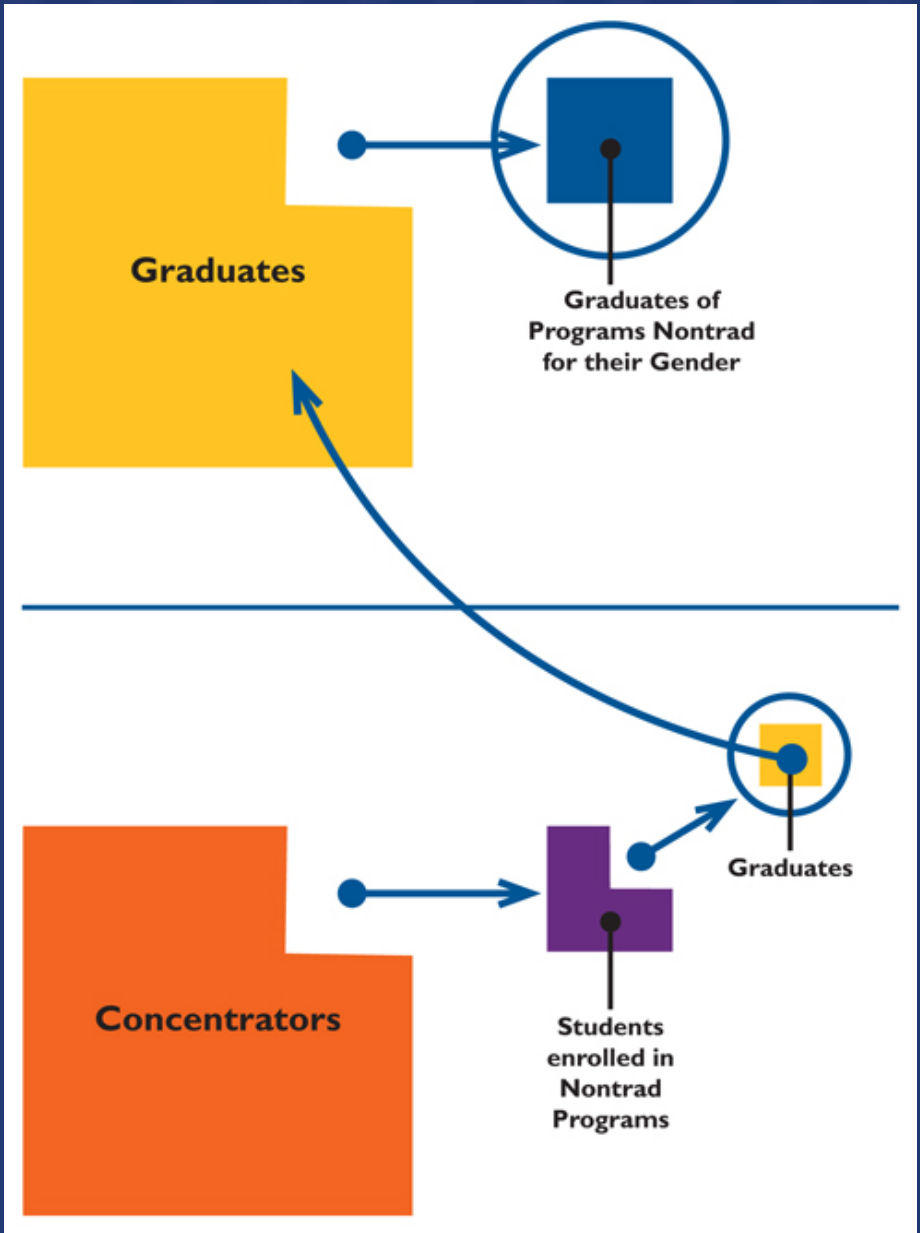
This graphic represents the relationship between the Perkins Secondary Performance Indicators and the CTE Participants and CTE Concentrators.



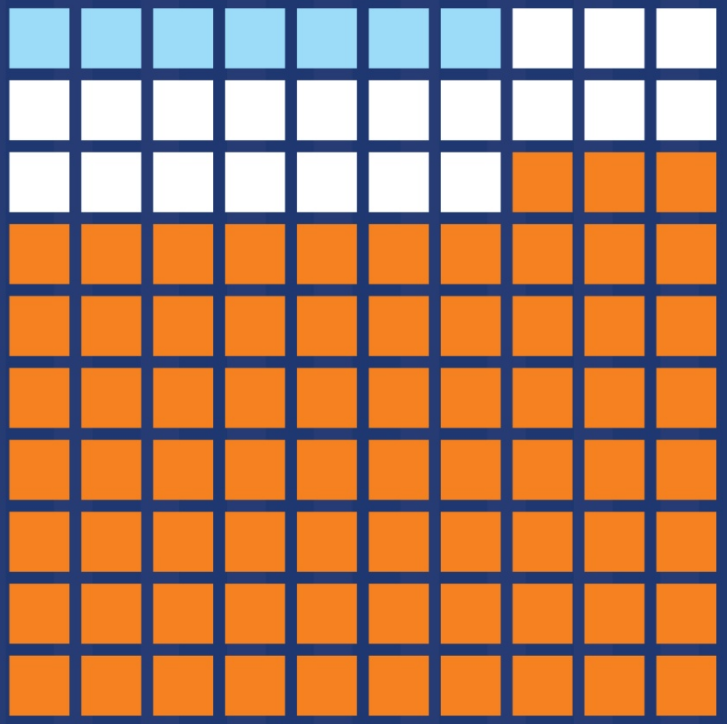
Fractions of Subpopulations (6S2)

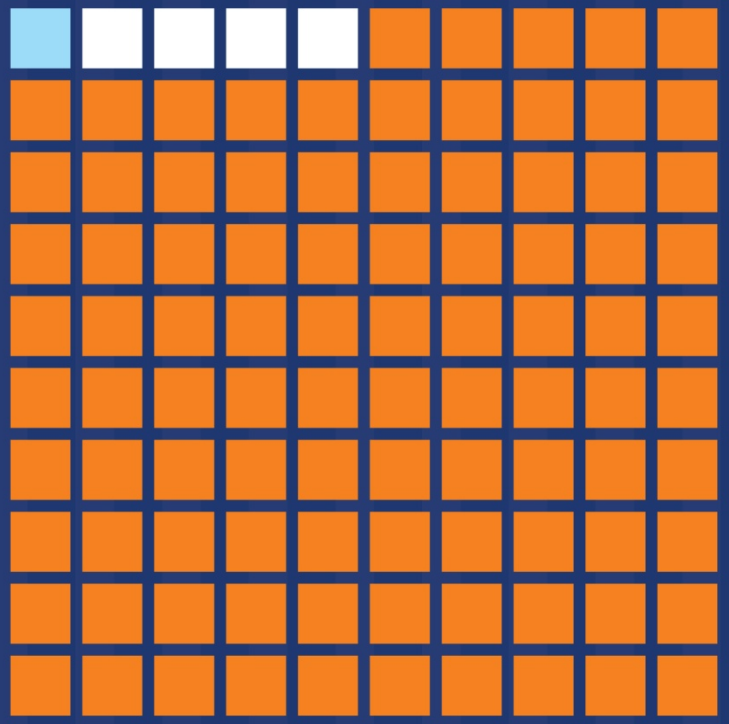
Numerator: Number of CTE concentrators from underrepresented gender groups who completed a program that leads to employment in nontraditional fields during the reporting year.

Denominator: Number of CTE concentrators who completed a program that leads to employment in nontraditional fields during the reporting year.



2009-2010 Nebraska Career Education





Nebraska Fall Membership

6S2: Nontraditional Completion

6S2 Numerator

6S2 Denominator

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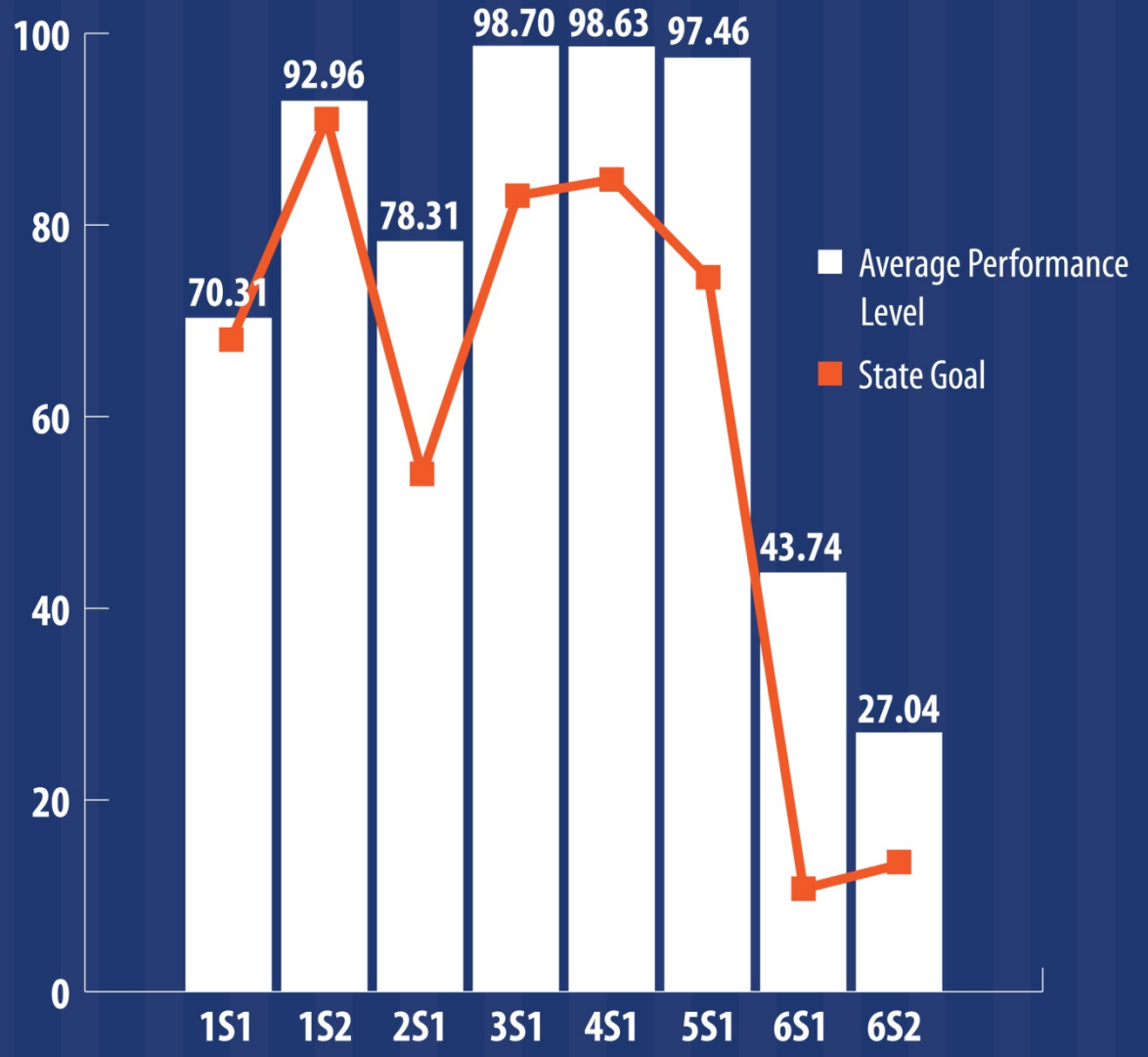

10-11 Secondary Average Performance

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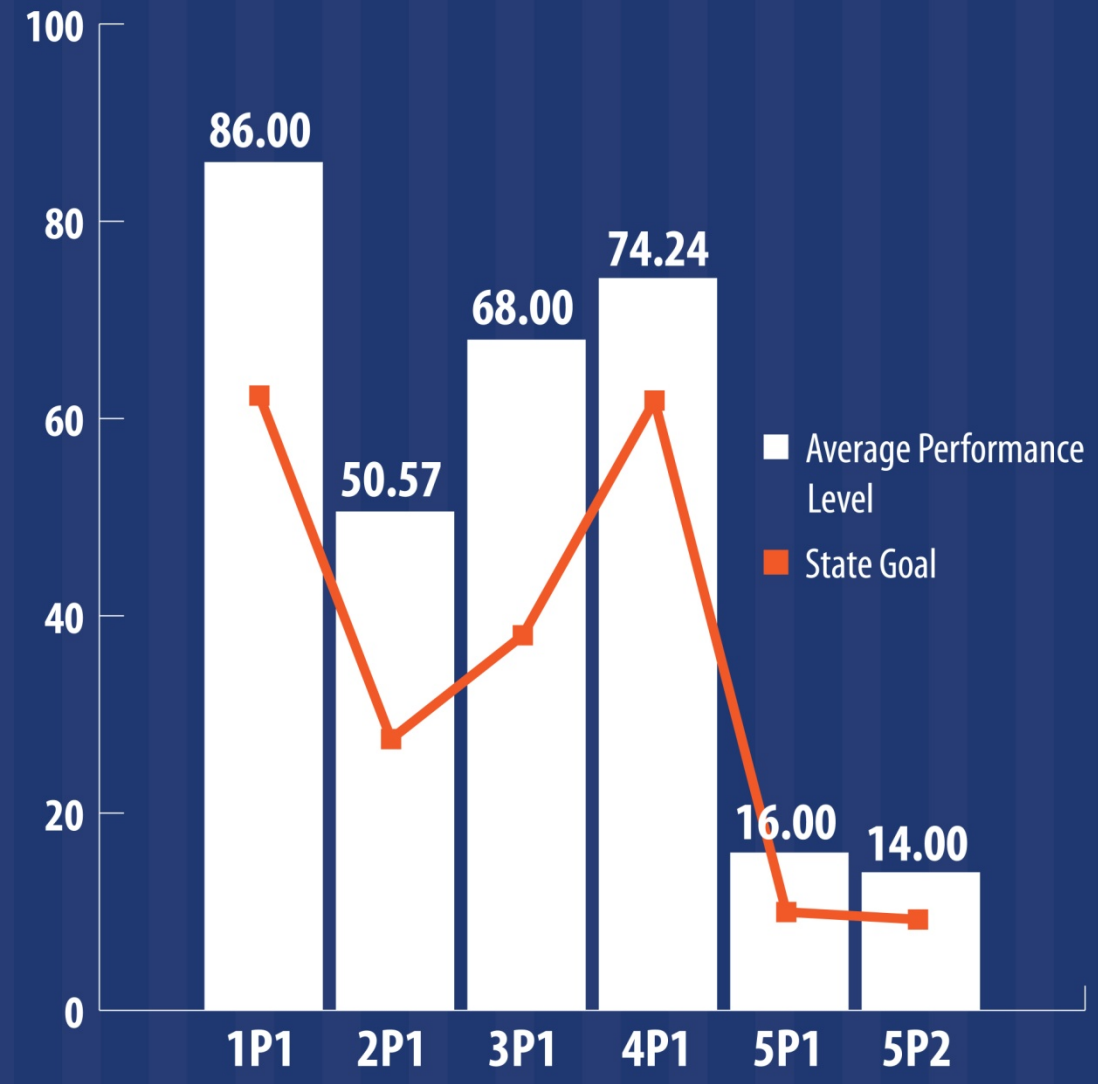

10-11 Postsecondary Average Performance

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Subpopulations

- Why does accountability focus on such small groups of students?
  - Federal investment is aimed at a subpopulation – CTE students
  - Policymaker determination that:
    - A return on investment will be seen in said measures
    - Compliance or fulfillment of the law will be revealed in said measures
      - How states are held "accountable" for accepting a federal investment

Subpopulation (continued)

- Ultimately then, the accountability framework ends up driving both policy and program decisions/energy
  - Examples:
    - Struggle to best define and operationalization performance indicators
    - Efforts to achieve nation-wide indicator standardization
    - Development and emergence of the Program of Study as a framework for implementing CTE in accordance with the intents and purposes of Perkins IV

Challenges

1. Like many accountability frameworks, this system *becomes* the mechanism for understanding and evaluating CTE student performance/learning
   - "Performance" indicators
   - But, performance relative to what?
     - an arbitrary state goal
   - Tail wagging the dog?

Challenges (continued)

2. Force an accountability system into a dual-purpose role:
   - Accountable for a federal investment
   - Assessment of student learning/outcomes
     - But these are not the same thing – or at least it is quite challenging and costly to develop such a system

Challenges (continued)

3. Thus, we judge the success or failure of CTE student learning/outcomes based on an *accountability* system designed by policymakers for, perhaps, a very different purposes
   – And, because Perkins IV is the product of a legislative process, these policy objectives – while well intentioned – may not be fully coherent in practice

Implications for CTE

1. Because the success or failure of CTE student learning/outcomes becomes based on CAR data, any misgivings about the reliability or validity of said data calls into question our efforts/purpose within education
   - In a data-driven world, this leaves us in a rather precarious position
     - All we can speak to is CAR data and anecdotes

Implications for CTE

2. Because the CAR data framework adopts a "strict" subpopulation evaluation, CTE student data is largely analyzed in isolation from other/larger student populations
   - So, even if the CAR data is deemed valid and reliable, we are left explaining only CTE student data – but relative to what…a state goal?
   - Okay, but what does this say about CTE students as part of a larger student population?

Implications for CTE

- Collectively, then, these challenges and implications characterize the problematic **“Locked in the CAR”** scenario.

More than Numbers?

- Do these accountability measures help us:
  - Make decisions about CTE?
  - Improve the quality of our decisions?
- Too often, we limit our use of education data to accountability purposes only.
- To enhance the quality of our decisions - more than numbers - diversify analytic strategies beyond the federal accountability framework.

Data Use Beyond Accountability

- Descriptive Analyses
  - Measures of Central Tendency
    - Mean, Median, Mode
  - Measures of Dispersion
    - Variance, SD, IQ Range
  - Measures of Association
    - Correlations
    - Probabilities
    - Odds Ratios
    - Relative Risk Ratios
- Inferential Analyses
  - Testing of Models
    - Linear Regression
    - Generalized Linear Model
    - Path and Structural Equation Models

Descriptive Analyses

- Measures of Central Tendency
  - Mean, Median, Mode
  - Used to identify the “typical” value and represents all numbers
  - Two major uses:
    - Simplification
      - knowing the average number as opposed to all numbers in a data vector
    - Prediction
      - Knowing the average score for previous years for next year

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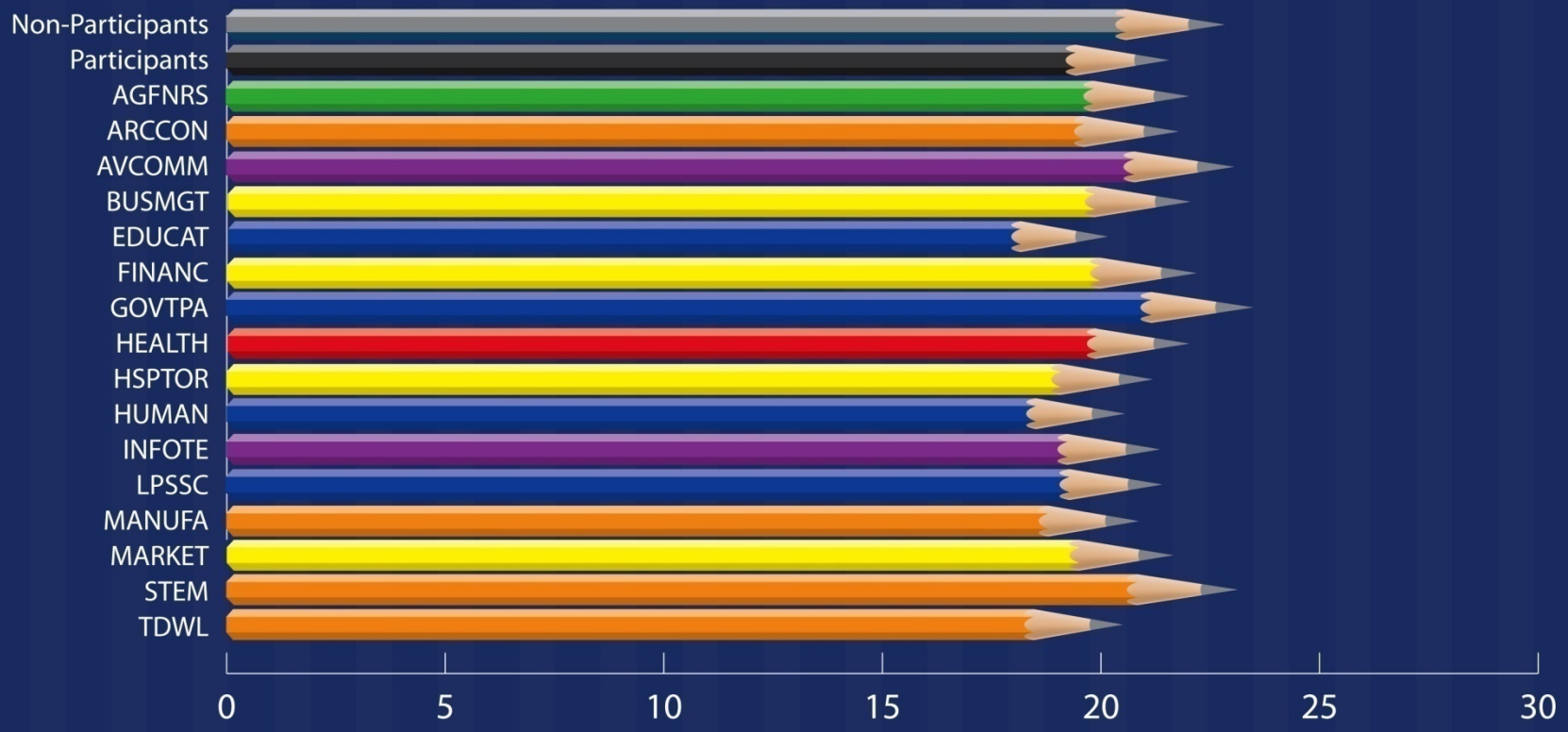

Descriptive Statistics: Average ACT Composite Score

By Participation | Career Field Status

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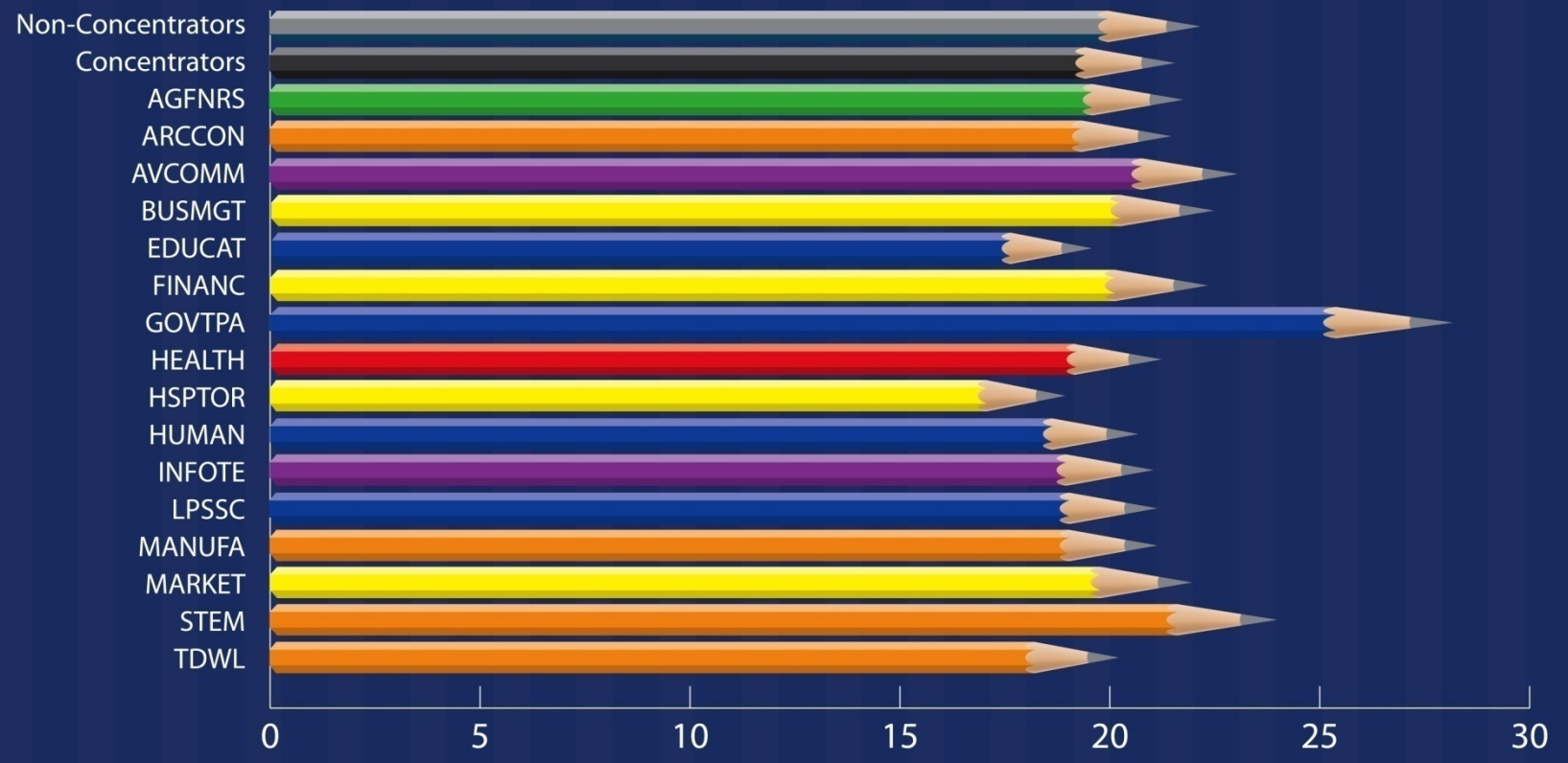

Descriptive Statistics: Average ACT Composite Score

By Concentrator | Career Field Status

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Descriptive Analyses

- Measures of Association
  - Is there a relationship between two variables?
    - For our purposes, often these are nominal variables
    - That is, a situation where each person is a member of a discrete category as opposed to each person receiving a numeric score
      - Is Career Education Status related to dropout status?
        - » Participant – Non-Participant
        - » Concentrator – Non-Concentrator
        - » Dropout – Non-Dropout

Descriptive Analyses

- The Contingency Table
  - AKA cross tabulation or “cross tabs”
  - For example, consider 100 CTE students completing a math examination

	Male	Female	Total
Passing	20	40	60
Not Passing	30	10	40
Total	50	50	100

Descriptive Analyses

	Gender								
Concentrator	**Male**			**Female**			**Total**		
	n	*Row %*	*Column %*	*n*	*Row %*	*Column %*	*n*	*Row %*	*Column %*
Yes	4,685	57.39	37.12	3,479	42.61	30.01	8,164	100.00	33.71
No	7,936	49.44	62.88	8,115	50.56	69.99	16,051	100.00	66.29
Total	12,621	52.12	100.00	11,594	47.88	100.00	24,215	100.00	100.00

Federal Accountability Framework:
57% of Nebraska CTE Concentrators are male, whereas
43% of Nebraska CTE Concentrators are female.

Data Diversification Framework:
57% of Nebraska CTE Concentrators are male, **compared to** 52% of the Nebraska 12th grade student population.
43% of Nebraska CTE Concentrators are female, **compared to** 48% of the Nebraska 12th grade student population.

Descriptive Analyses

	Gender								
Concentrator	**Male**			**Female**			**Total**		
	n	*Row %*	*Column %*	*n*	*Row %*	*Column %*	*n*	*Row %*	*Column %*
Yes	4,685	57.39	37.12	3,479	42.61	30.01	8,164	100.00	33.71
No	7,936	49.44	62.88	8,115	50.56	69.99	16,051	100.00	66.29
Total	12,621	52.12	100.00	11,594	47.88	100.00	24,215	100.00	100.00

Federal Accountability Framework:
57% of Nebraska CTE Concentrators are male, whereas
42% of Nebraska CTE Concentrators are female.

Data Diversification Framework:
57% of Nebraska CTE Concentrators are male, **compared to** 52% of the Nebraska 12th grade student population.
42% of Nebraska CTE Concentrators are female, **compared to** 48% of the Nebraska 12th grade student population.

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The odds ratio is a way of comparing whether the probability of a certain event is the same for two groups.

An odds ratio of 1 suggests an event is equally likely in both groups. An odds ratio greater than 1 suggests an event is more likely in the first group. And odds ratio less than 1 suggests an event is less likely in the first group.

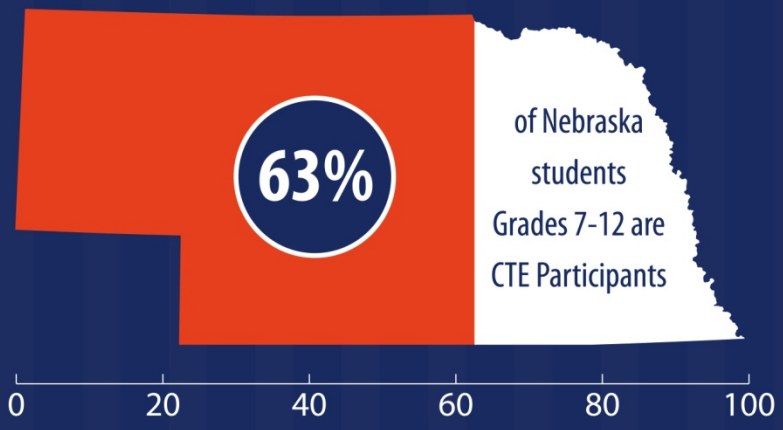
	Non-Dropout	Dropout	
Non-Concentrators	a	b	a+b
Concentrators	c	d	c+d
	a+c	b+d	n=a+b+c+d

$$\text{Odds Ratio} = \frac{a/b}{c/d} = \frac{ad}{bc}$$

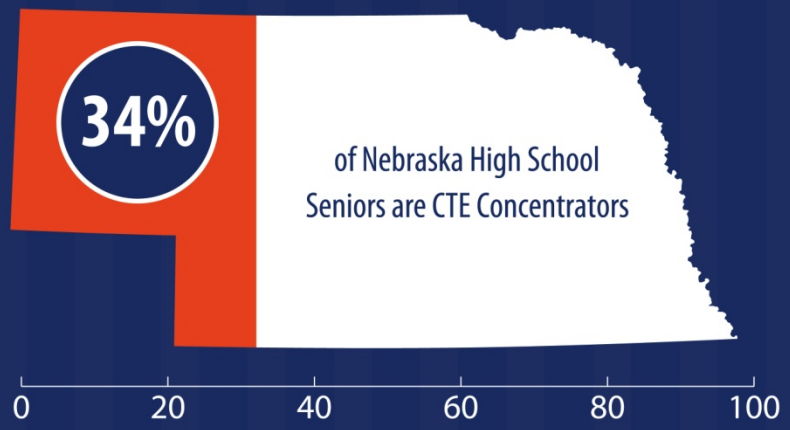
Descriptive Statistics: Odds Ratios

Concentrators vs. Non-Concentrators

2010-2011 Nebraska Career Education



Participants



Concentrators

Descriptive Statistics: CTE Students

Participants and Concentrators

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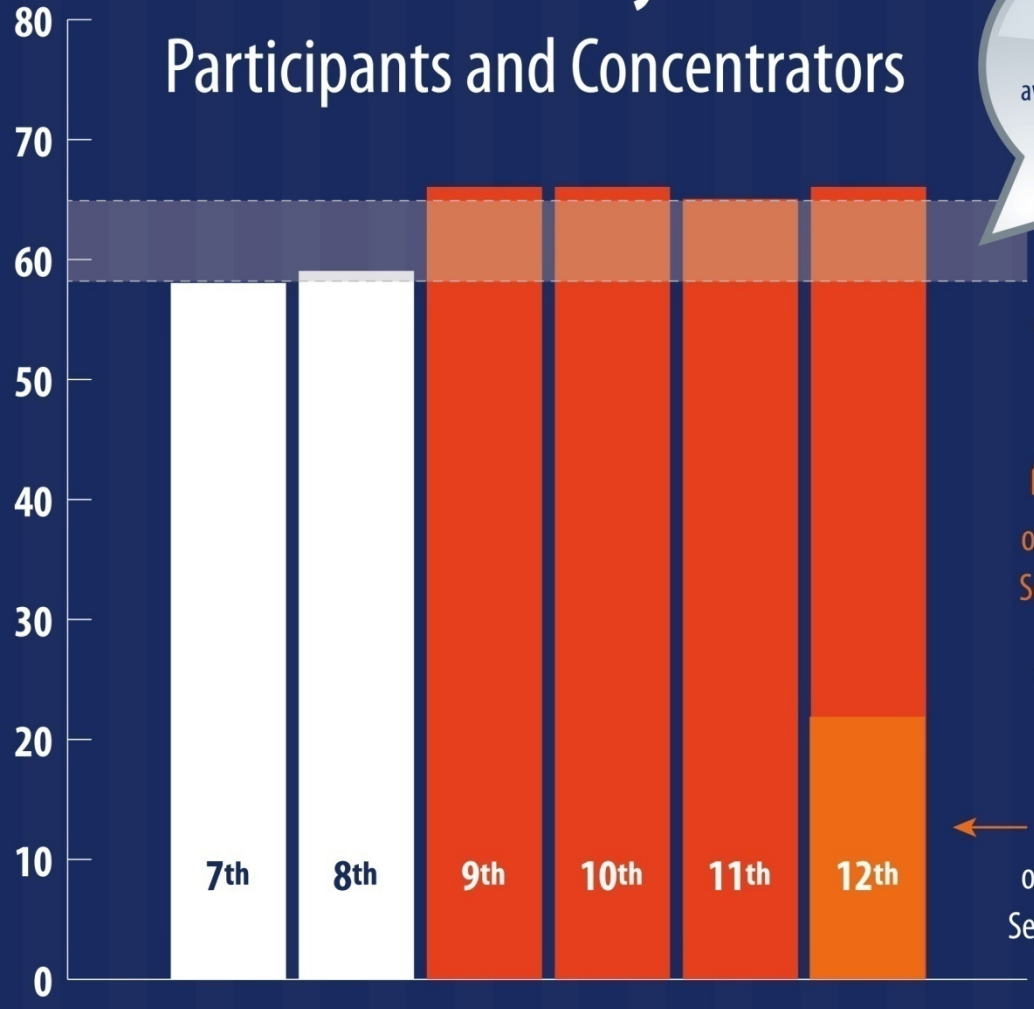
Descriptive Statistics: CTE Students by Grade

Participants and Concentrators



7.25%
average increase in Participants between Junior High & High School

2/3
of all Nebraska High School Seniors are CTE Participants

1/3
of all Nebraska High School Seniors are CTE Concentrators

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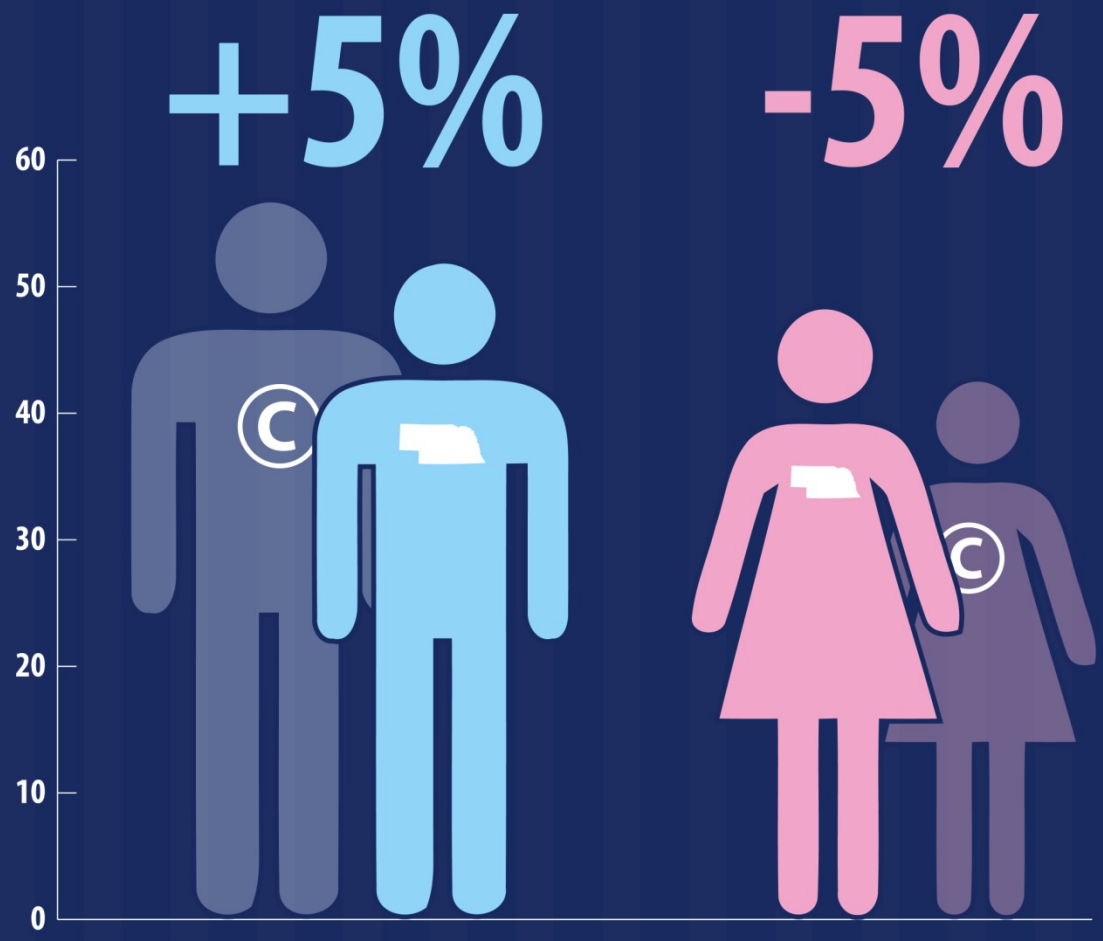

Descriptive Statistics: Gender

Concentrators vs. All High School Seniors

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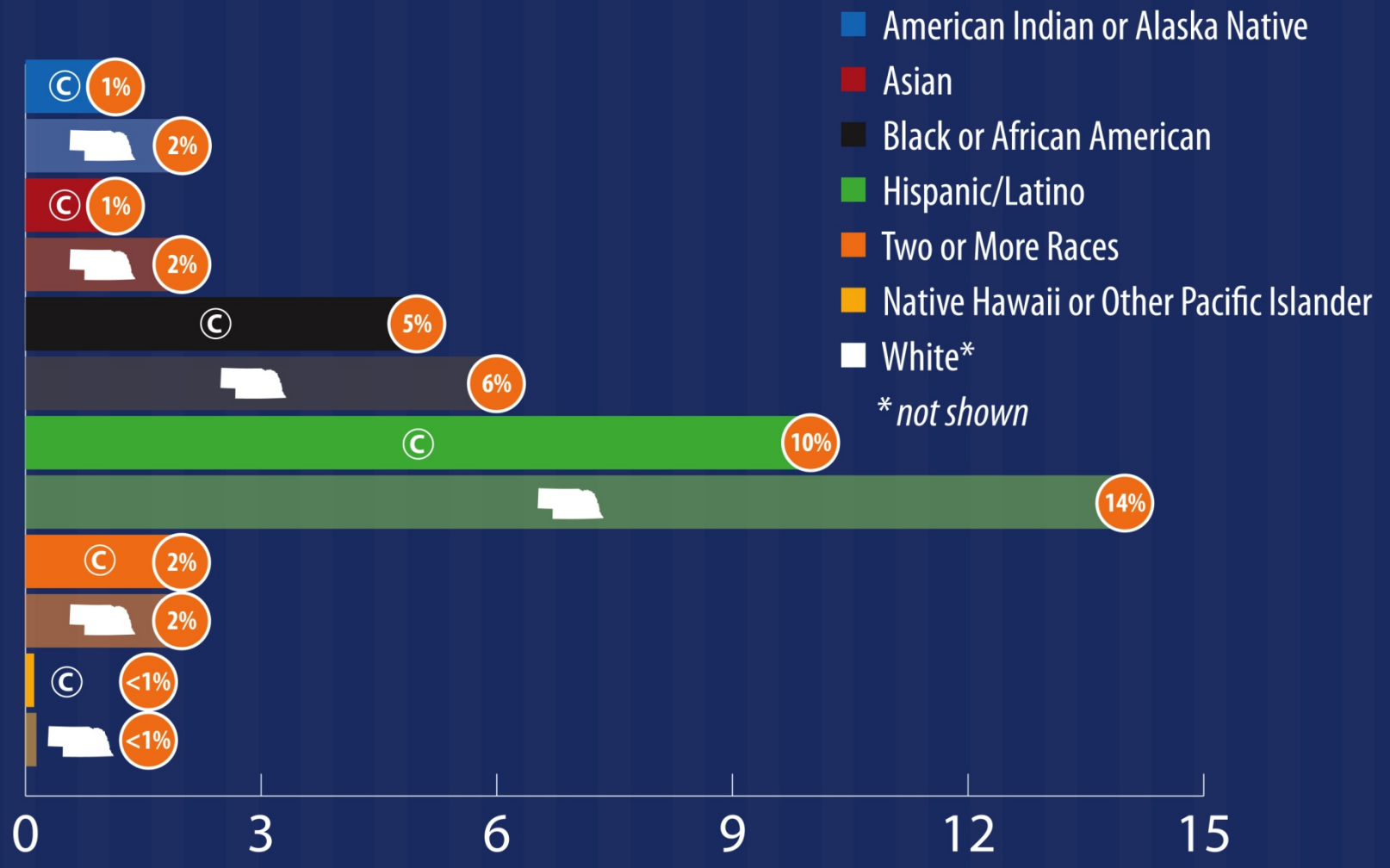

Descriptive Statistics: Ethnicity

Concentrators vs. All High School Seniors

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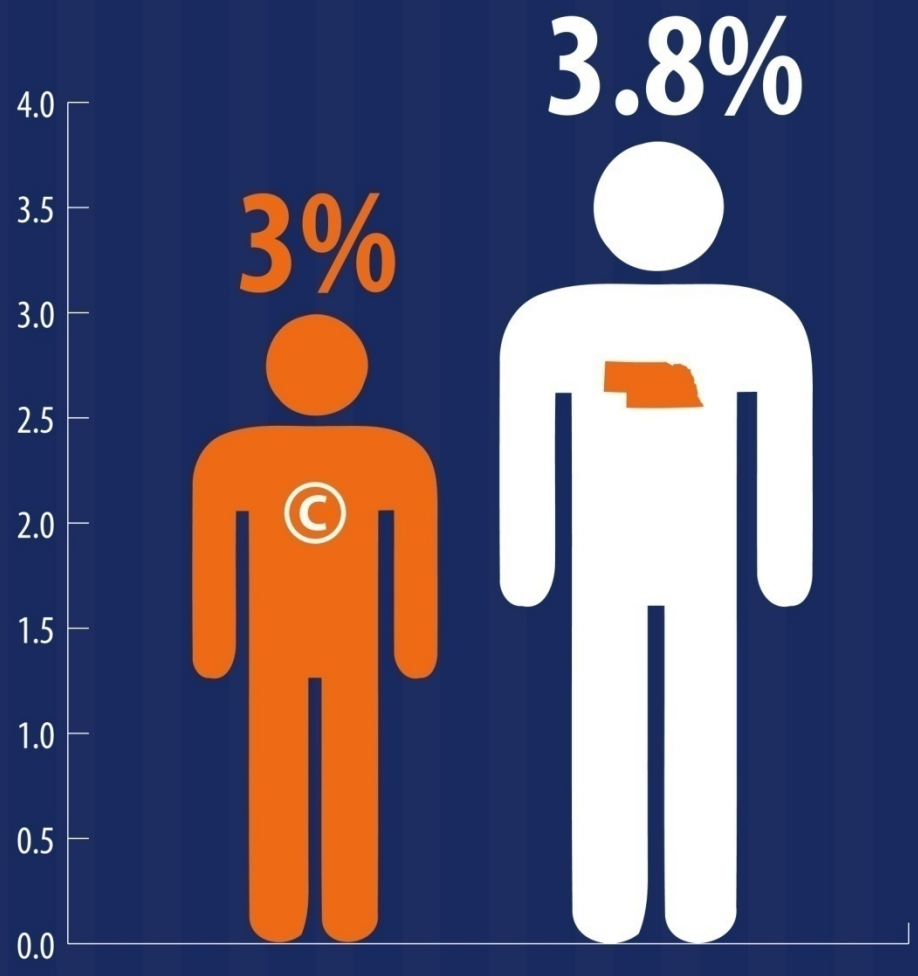

Descriptive Statistics: Immigration Status

Concentrators vs. All High School Seniors

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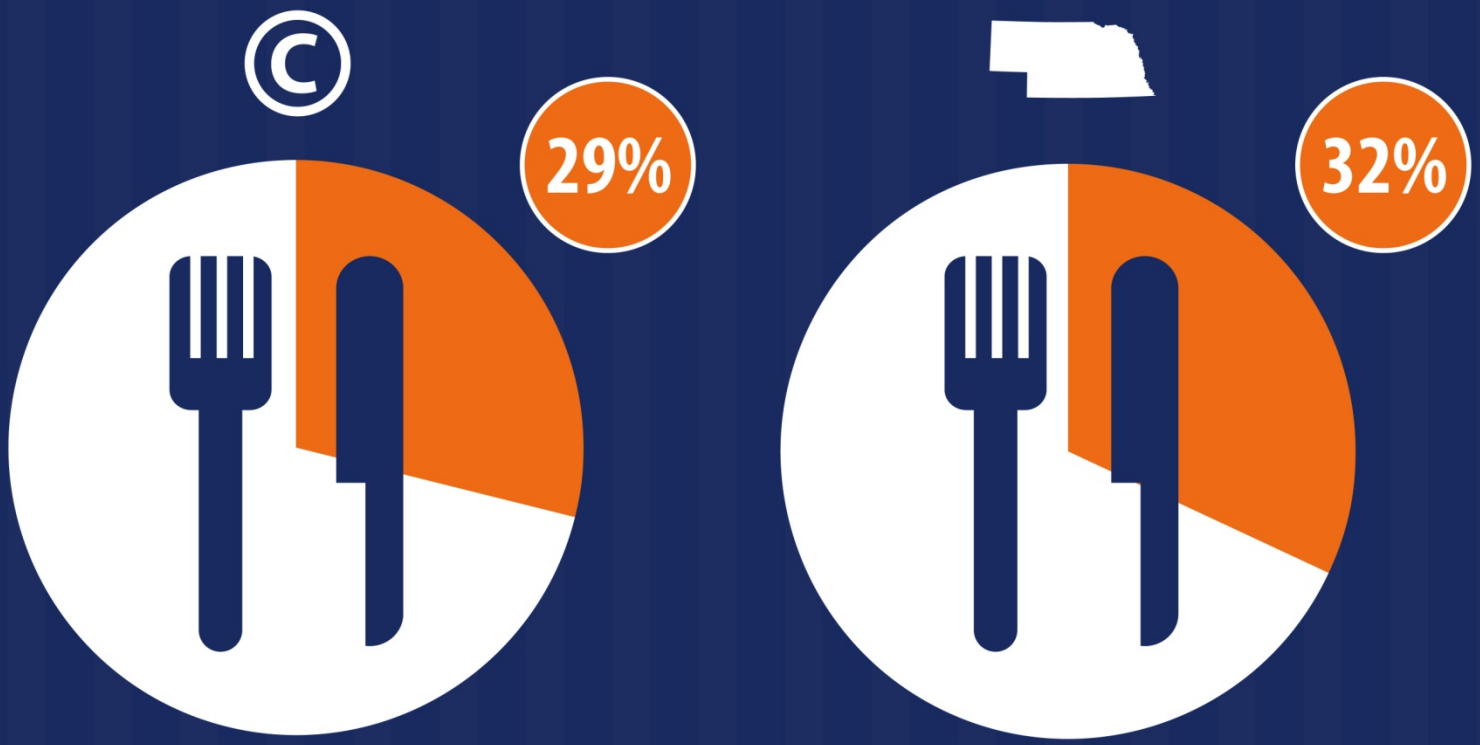

Descriptive Statistics: Food Program Eligibility

Concentrators vs. All High School Seniors

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Descriptive Statistics: Gifted Eligibility

All High School Seniors vs. Concentrators

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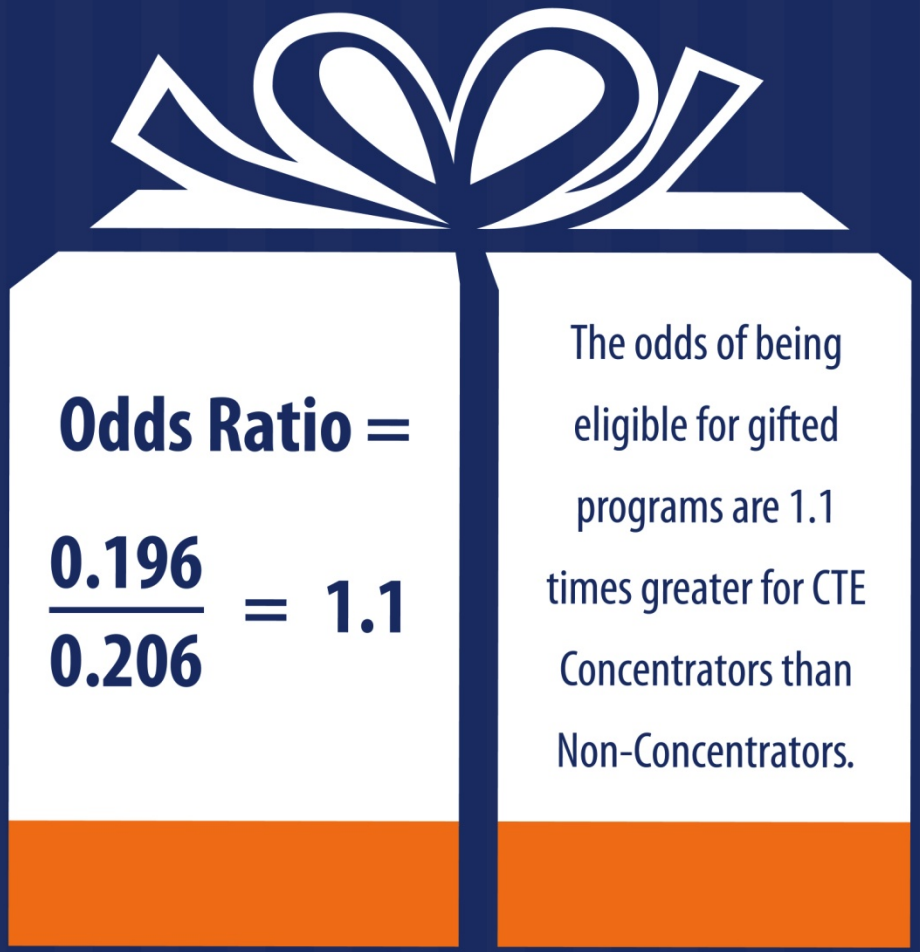

Descriptive Statistics: Gifted Eligibility

Concentrators vs. Non-Concentrators

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33%

of CTE Concentrators take AP or Honors Courses

Whereas

26%

of all High School Seniors take AP or Honors Courses

Descriptive Statistics: AP or Honors Courses

Concentrators vs. All High School Seniors

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The odds of participating in AP or Honors Courses are 1.6 times greater for CTE Concentrators than Non-Concentrators.

Odds Ratio =

$$\frac{0.485}{0.295} = 1.6$$

Descriptive Statistics: AP or Honors Courses

Concentrators vs. Non-Concentrators

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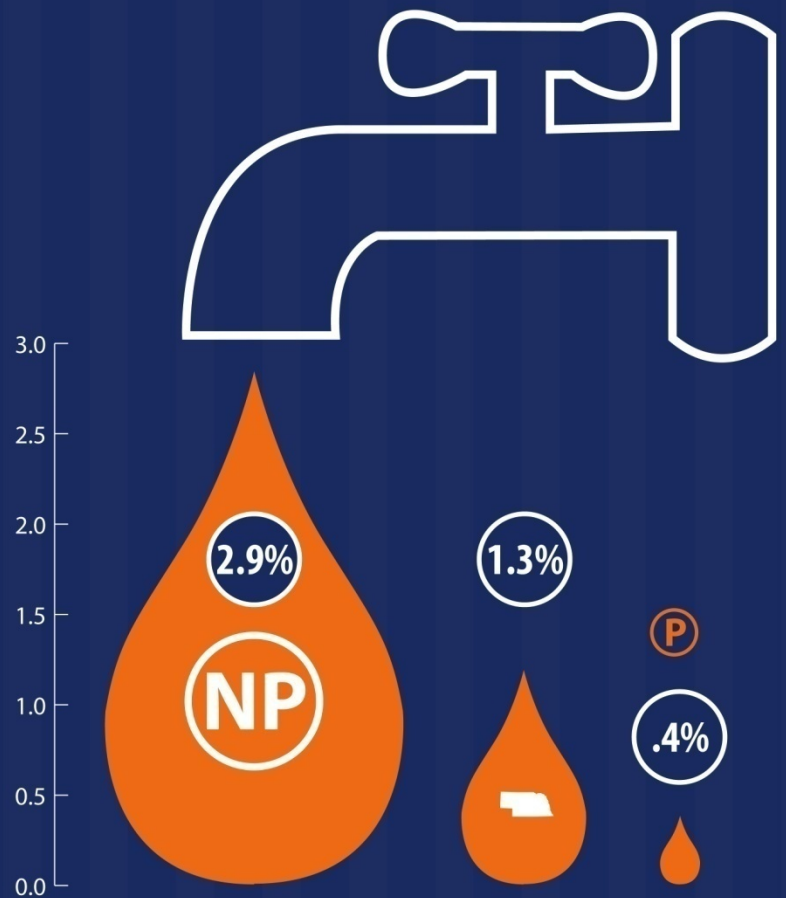
2010-2011 Nebraska Career Education



0.4% of students grades 7-12 participating in Career Education dropped out of school

Compared to

2.9% of students grades 7-12 *not* participating in Career Education.

Overall, 1.3% of all Nebraska students grades 7-12 dropped out of school.

Descriptive Statistics: Dropouts

Non-Participants, All Students Grades 7-12, Participants

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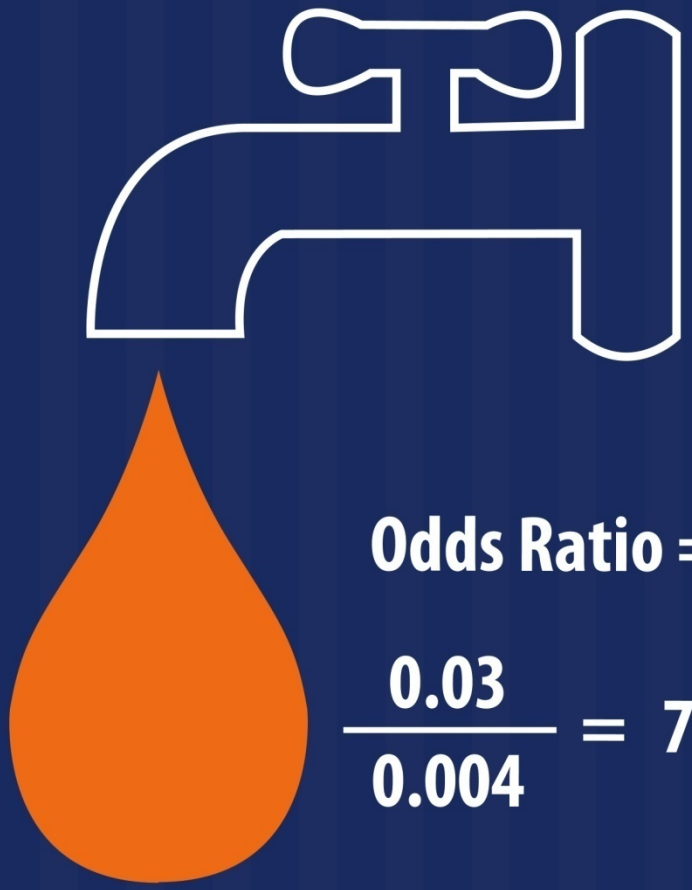
2010-2011 Nebraska Career Education



Odds Ratio =

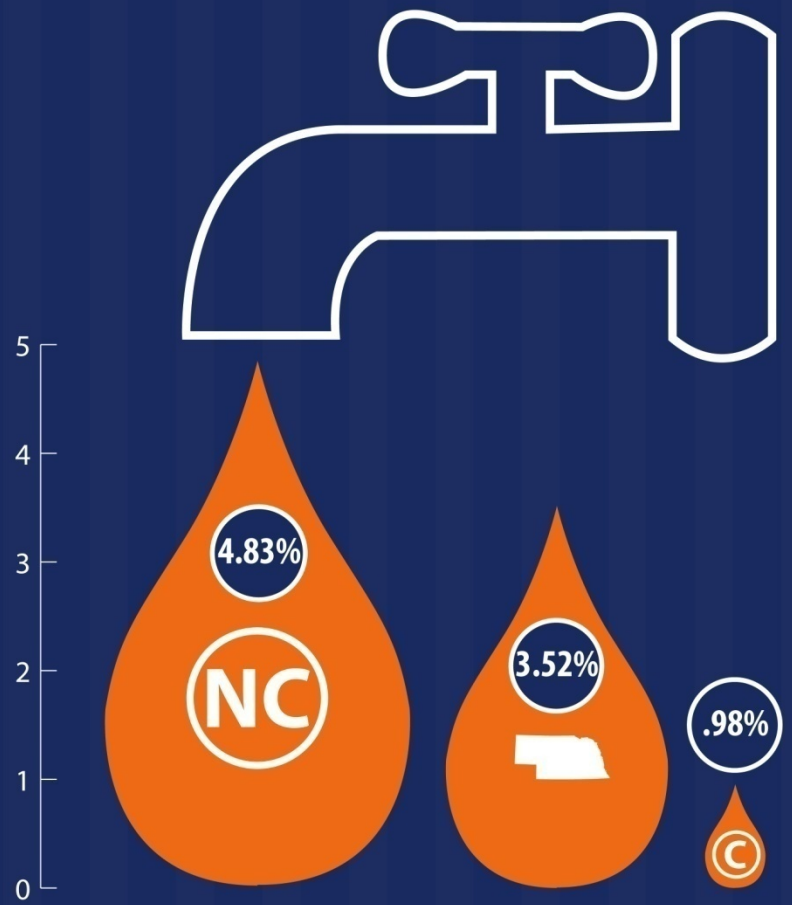
$$\frac{0.03}{0.004} = 7.4$$

The odds of being classified as a dropout are 7.4 times greater for students not participating in CTE than CTE Participants.

Descriptive Statistics: Dropouts

Non-Participants vs. Participants

2010-2011 Nebraska Career Education



0.98% of students in grade 12 concentrating in Career Education dropped out of school

Compared to

4.83% of students in grade 12 *not* concentrating in Career Education.

Overall, 3.52% of all Nebraska students in grade 12 dropped out of school.

Descriptive Statistics: Dropouts

Non-Concentrators, All Students Grade12, Concentrators

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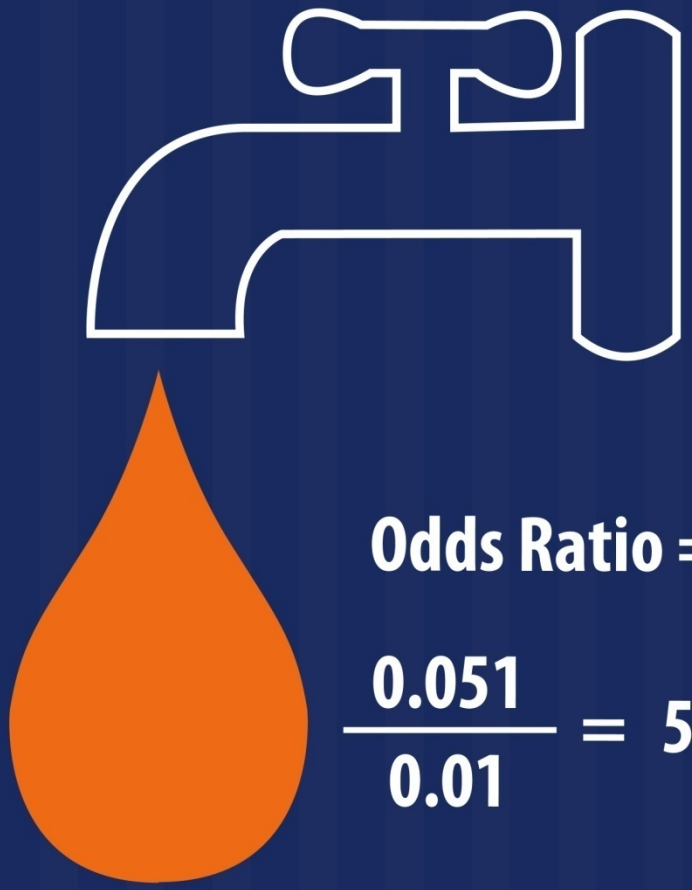
2010-2011 Nebraska Career Education



Odds Ratio =

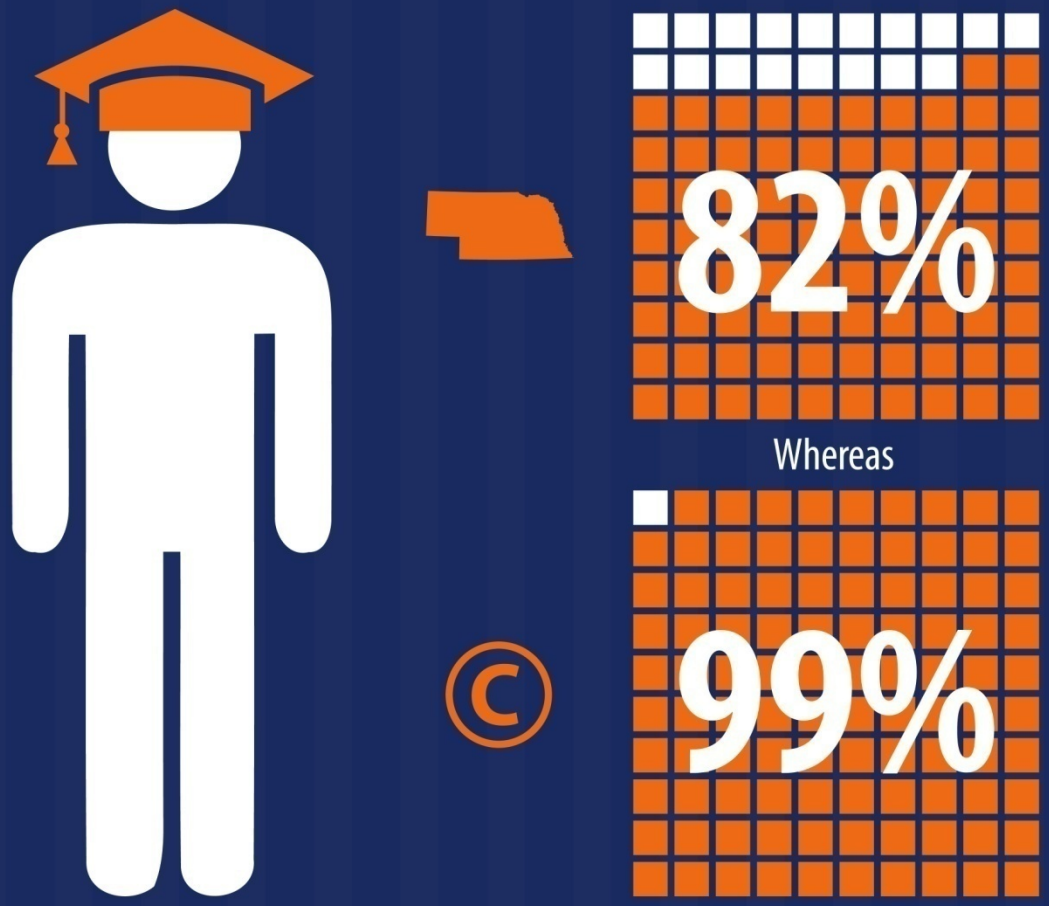
$$\frac{0.051}{0.01} = 5.1$$

The odds of being classified as a dropout are 5.1 times greater for students not concentrating in CTE than CTE Concentrators.

Descriptive Statistics: Dropouts

Non-Concentrators vs. Concentrators

2010-2011 Nebraska Career Education



of Nebraska high school seniors completed an approved program of study and met district/system requirements for a high school diploma

Whereas

of CTE Concentrators completed an approved program of study and met district/system requirements for a high school diploma

Descriptive Statistics: Completer with Diploma

All High School Seniors vs. Concentrators

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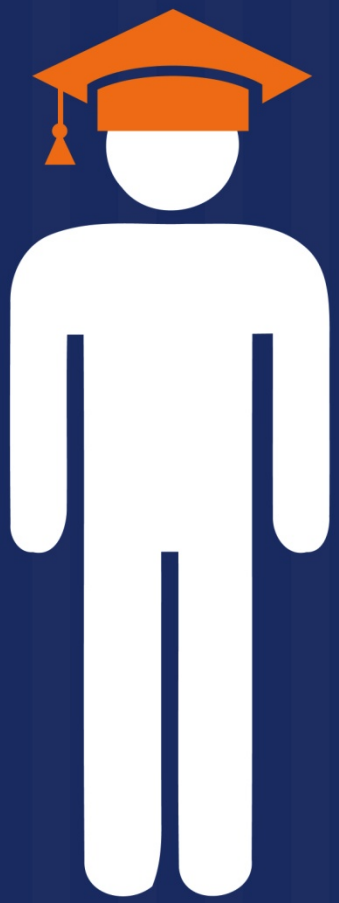
2010-2011 Nebraska Career Education



The odds of completing an approved program of study and meeting district/system requirements for a high school diploma are 25.6 times greater for CTE Concentrators than students not concentrating in CTE.

Odds Ratio =

$$\frac{72.09}{2.81} = 25.6$$

Descriptive Statistics: Completer with Diploma

Concentrators vs. Non-Concentrators

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Data Use Beyond Accountability

- Descriptive Analyses
  - Measures of Central Tendency
    - Mean, Median, Mode
  - Measures of Dispersion
    - Variance, SD, IQ Range
  - Measures of Association
    - Correlations
    - Probabilities
    - Odds Ratios
    - Relative Risk Ratios
- Inferential Analyses
  - Testing of Models
    - Linear Regression
    - Generalized Linear Model
    - Path and Structural Equation Models

Inferential Analyses

- Binomial Logistic Regression
  - An extension of the generalized linear model
  - Used to predict a discrete, dichotomous (takes the form of two categories) dependent variable
    - Dropout – Not a Dropout
  - Utilizes the logit link function:
    - $g(x)=\log(x/(1-x))$
  - Parameter estimation produced via maximum likelihood estimation

Inferential Analyses: Dropouts

Predictor	Coefficient	Standard Error	Odds Ratio
CTE Participant (No)	2.002***	0.0589	7.405
Constant	-5.520***	0.0528	0.0002

Note: n = 142,570, LR chi squared = 1541.38***, df = 1, *p < .05. **p < .01. ***p < .001

Predicted Logit (Dropout=1) = $\alpha + \beta 1 \times$ CTE Participant Status

Relative to CTE Participants, the odds of being classified as a dropout are 7.405 times higher for students NOT participating in Career Technical Education.

Predictor	Coef.	SE	OR	Predictor	Coef.	SE	OR
CTE Participant (No)	0.577***	0.0781	1.781	Single Parent	0.517***	0.1478	1.677
Female	-0.330***	0.0635	0.719	Food Program			
Days Membership	0.02***	0.0013	1.02	Free Meals	-0.422***	0.0671	0.656
FTE Percent	0.036***	0.0064	1.036	Reduce Meals	-0.387**	0.1469	0.679
AP or Honors Participant	-0.983***	0.1697	0.374	Ethnicity			
LEP Eligible	0.410***	0.1483	1.507	Asian	-0.465	0.2726	0.628
Gifted Participant	-0.781***	0.2592	0.458	Black	0.231*	0.0992	1.26
Imigrant				Hispanic	0.331***	0.0828	1.393
< 1 Year	0.277	0.2791	1.319	Multiple	-0.203	0.202	0.817
<=1 Year >= 3 Years	0.706**	0.2605	2.027	Pacific Islander	-0.268	0.752	0.767
> 3 Years	0.222	0.1615	1.248	American Indian	0.085	0.1514	1.089
Homeless	0.611***	0.1603	1.843	Grade Level	0.6794***	0.0258	1.973
Days Attendance	-0.049***	0.0015	0.952	Constant	-12.338***	0.7035	4.383

Note: n = 137,478, LR chi squared = 6662.88***, df = 22, *p < .05. **p < .01. ***p < .001

Conclusion

- Understand the realities of the Federal CTE accountability framework, including the benefits and drawbacks
- Recognize the value in adopting diverse data analytic strategies
- Gain practical suggestions for diversifying CTE data analyses to include larger populations of students

For more information, please contact:

Matt Hastings
Nebraska Department of Education
301 Centennial Mall South · P.O. Box 94987
Lincoln, NE 68509-4987
Phone: 402-471-3104 · Fax: 402-471-4565
Email: matt.hastings@nebraska.gov

Website:
http://www.education.ne.gov/NCE/DRAW/index.html