ORIGINAL ARTICLE

Telling My Story: Applying Storytelling to Complex Economic Data

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Abstract

Our experience with business and economic students indicates limited understanding and confidence when working with macroeconomic data such as unemployment rate, labor force participation rate, business cycles, and price indexes. To close this gap, the authors have developed and evaluated a college classroom experiential activity defined as the Storytelling Project (SP) conducted in nine principles of economics courses in a mid-size private university over a period of two years during the COVID-19 pandemic. In the SP, students wrote personal stories that assisted them in connecting with their audience and then visually presented complex economic data. A workbook supplemented the SP with learning objectives, tasks, multiple examples of data analysis, storytelling techniques, and videos. Participants completed a self-efficacy and attitude survey of perceived cognition, confidence, and motivation and took an assessment to evaluate cognitive competencies. The survey and assessment results were compared against students who did not complete the SP. Our results indicate that the SP and the workbook are effective experiential learning activities that improve data analysis and communication skills among college students. Students show more confidence and motivation in macroeconomics and data analysis at the end of the semester. Knowledge or cognitive competency is ranked higher among those completing the SP.

Keywords Experiential learning · Storytelling · Macroeconomic data analysis · Communication skills · Pedagogical tools

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Introduction

Economic data analysis and data-driven presentations are skills in high demand in almost any industry in the United States (US) and abroad. From health and sports to retail and manufacturing, every sector in the economy collects data and makes decisions supported by these figures. However, analyzing economic data can be a challenging task for students, particularly those who are exposed to evaluating the meaning and implications of data during class discussions (Ramadan and Hussein 2017; Wuthisatiana and Thanetsunthorn 2019). To improve data analysis and communication skills among college students, we designed an experiential learning activity consisting of collecting complex economic data, developing graphs, presenting the data in a visually appealing format, and at the same time connecting with their audience, by sharing a personal story. The activity is defined as the Storytelling Project (SP) and consisted of three assignments throughout the semester, including the development of a short story, and culminated in a five-minute video presentation. The evidence collected in this study suggests that the SP promotes a more confident, knowledgeable, and engaged student and improves soft skills, such as oral communication.

Ample evidence shows the effectiveness of experiential learning activities over traditional teaching approaches in improving students' engagement and understanding of the material (Gosen and Washbush 2004; Herz and Merz 1998; Voukelatou 2019). For instance, courses that include case studies, internships, in-site visits, games, and social media as a vehicle of learning display positive results in terms of hard and soft skills development, such as data analysis and oral communication (Flores and Savage 2007; Frontczak and Kelly 2000; Geerling 2012; Gulley and Jackson 2016; Jones and Baltzersen 2017; Kayes et al. 2005; Ray 2018). In addition, college students' test scores and long-term assessment records are significantly higher among those students exposed to experiential activities (Christopher and Marek 2009; Steinhorst and Keeler 1995; Yoder and Hochevar 2005). However, the literature on effective experiential activities in economics courses is still limited, and the results warrant further investigation (Dolan and Stevens 2010; Spencer and Van Eynde 1986).

The effectiveness of an experiential activity in the classroom is linked to the how and why. That is, students must complete activities that take them through a process of academic growth, so they can process and evaluate what they are doing. These class activities could include a set of tasks, self and peer evaluation at different stages, or a research journal so that students can recognize, adjust, and improve their work (Carlson and Winquist 2011; Chavan 2011; Kolb 2007). At the same time, students must recognize the purpose of the activities by having clear learning objectives and expectations linked to the tasks. Better yet, the experiential activity is more constructive when accompanied by a workbook or other written material that provides detailed information, examples, task instructions, and rubrics (Flanagan et al. 2005; Wallace and Jefferson 2015).

The study aims to develop an experiential learning activity for principles of macroeconomics courses accompanied by a workbook, followed by an evaluation

of its effectiveness. The authors compare self-efficacy, motivation, anxiety, effort, and understanding of macroeconomic data analysis and graphs among two groups of college students: those who completed the Storytelling Project (SP) and those who did not. The workbook was created to supplement the SP with learning objectives, tasks, multiple examples of data analysis and storytelling techniques, rubrics, and videos. The key component of the SP is the development of a personal story using the three stages of the Storytelling approach (Goaz 2020; Knaflic 2015).

This study contributes to the literature in many ways. First, few experiential activities provide a supplementary workbook with learning objectives, tasks, multiple examples, rubrics, and videos. The workbook promotes a more independent learner and reduces classroom time for task instruction. Second, the SP and the workbook are learning tools that are centered on students rather than the lecturer: the story is developed and presented by the students. Third, the SP aims to instill highly desirable skills in the marketplace, such as data analysis and communication skills. Fourth, we evaluate the experiment using two complementary assessment tools: a test of cognition and a survey of self-efficacy and attitudes, providing different methods to determine the project's effectiveness. Finally, the results from our experiment indicate that students retain more information and self-evaluate their own capacities, skills, and motivations better if they have more opportunities and time to participate in the experiential activity (Hawtrey 2007; Obi et al. 2022).

This paper has six sections. Section "Literature Review" describes the literature in the areas of experiential learning and the storytelling approach. Section "The Background of the Storytelling Project" describes the storytelling project (SP), the classroom setup, and the assessment tools used when evaluating this type of experiential learning activities in the college classroom. Section "Research Design" provides the experiment design, which was completed during 2020–2021 (the first two years of the Coronavirus pandemic disease COVID-19), and Section "Data Analysis" presents the results. After comparing both groups, those completing the SP and those not completing the SP, our results indicate that the SP group shows a better understanding of macroeconomics data and graphs. These students also show higher self-efficacy, less anxiety, and more effort in completing coursework. Finally, Section "Conclusions and Recommendations for Future Research" provides concluding remarks and discusses different ways this project can be adapted to other introductory economic and business courses.

Literature Review

Economic Data Analysis in the College Classroom

Studies on higher education show that college students who take principles of economics tend to complete the course with a limited understanding of macroeconomic data analysis (Klein et al. 2019; Hansen et al. 2002; Staveley-O'Carroll 2018; Walstad and Allgood 1999). Part of the problem arises from the few opportunities for students to engage in active and cooperative learning with data and graphs, which

improves the retention of complex ideas (Carlson and Velenchik 2006; Cohn and Cohn 1994; Salemi et al. 1996). Teaching with data has long been a central pillar of educational practices in STEM (Science, Technology, Engineering, and Mathematics) disciplines and now is at the core of pedagogy in Economics.

The pedagogical use of current macroeconomics data is necessary across the business curriculum and has been advocated by leading scholars in economic education (Mendez-Carbajo 2020a; Staveley-O'Carroll 2018). Data analysis allows students to reach a deeper understanding of abstract concepts in economics and to develop analytical and communication skills (Santos and Lavin 2004; Wolfe 2020). However, analyzing macroeconomic data in the classroom can be a daunting task for educators due to the potential effects of increasing attrition rates, students' anxiety, difficulty in grasping the concepts to be applied during the exercise, and extensive time outside and inside the classroom to prepare and evaluate these activities (Chermak and Weiss 1999; Remmen and Froyland 2014; Wurdinger and Allison 2017). Cumulatively, these factors weigh heavily during the course design. This paper aims to assist educators in this area by developing and implementing an experiential learning project in which students actively engage in data management, analysis, and presentation, with manageable preparation and grading work for the educator.

Experiential Learning Activities in Economics Courses

Experiential learning is a process in which students are exposed to concrete and well-designed experiences or activities followed by a reflective analysis and evaluation (Dewey 1938; Ferguson et al. 2016; Kolb and Kolb 2005). In the specific case of business college courses, the usage of case studies, field trips, service learning, mock scenarios, games, and interactive simulations have been extensively applied (Elam and Spotts 2004; Gremler et al. 2000; McCarthy and McCarthy 2006). For instance, Carlson and Velenchik (2006) designed a case-study method that posts macroeconomic policy scenarios and encourages students to discuss the economic principles applied in such scenarios, increasing the use of higher-order cognitive skills, such as data analysis and data-driven communication. Mendez-Carbajo (2020a) describes the contributions of active learning tasks using the Federal Reserve Economic Data (FRED) in economic courses, such as mastering basic graph-developing and graph-editing in Excel, calculating price-elasticities, and comparing nominal and real wages. They conclude that students exposed to FRED activities gain a deeper understanding and appreciation of the course and hone data analysis skills.

To effectively teach macroeconomics using data, we advocate student participation and group discussion having a central role (Erekson et al. 1996, Mendez-Carbajo 2020b). That is, data analysis as an application of economic theory should be wrapped around an experiential learning activity. We developed a class activity defined as the Storytelling Project (SP), which consists of three assignments throughout the semester, culminating in a video presentation. The learning objectives, assignments, and examples are described in a workbook (see Appendix 1). In the SP, students collect macroeconomic data and construct a set of graphs. Then, they develop a personal story as an introduction to their

presentation. Data show that the SP and other similar projects promote a deeper understanding of complex economic data, and build communication skills (Emerson and Taylor 2004; Yamarik 2007).

Storytelling as an Effective Experiential Learning Activity

Storytelling is a form of communication that can easily convey complex facts such as data and graphs (Caminotti and Gray 2012; Morgan et al. 2018). Students remember more facts and information when presented in a story because stories trigger the brain to connect with the information. (Lerner, et al. 2011; Zak 2014). Davidhizar and Lonser (2003) use a variety of storytelling techniques in an introductory course for undergraduate nursing students. During one lecture, the professor tells a personal story about an unsuccessful patient-nurse interaction. At the end of the course, students frequently report having strong feelings about the story and the academic solutions discussed after the resolution of the story. The same authors also request that students develop their own stories based on a nurse-client prompt. They find that students strongly agree that the storytelling activity makes the class more interesting and helps them remember key concepts. Similarly, Bryant and Harris (2011) use stories in place of textbook lectures and conclude that students exposed to the stories, as opposed to the lecture, perform better on a quiz. They also find that a significant portion of students report being more interested in the topic and had increased recollection of the learning material.

Storytelling also makes connections between abstract theory and reality (Lawrence and Paige 2016). Gold and Holman (2001) introduce an experiential storytelling project as part of a management development course. Students write stories about personal work experiences and present them to each other in small groups. Students report that writing and telling their stories helps them better understand complex management theories and leads to deeper self-reflection about the learning material.

According to McCloskey (2005), economists are natural storytellers. She posits that economists use stories to explain and understand the economic past. For example, she tells a story of the effect of a tax policy on unemployment and wage rate by describing the events as the plot, explaining what happened and why, and allowing the listener to ponder the outcome. Schiller (2017) explains that narratives are memorable conversations that influence our decisions. Colander (2005) argues that professors should tell stories to teach undergraduate economics and calls this exercise as the "practical experience guided by theory." (p 256). Finally, Wolfers (2019) claims that economics is more useful to students when it is part of a story. However, these economists have addressed the effectiveness of storytelling when used by the instructor. To our knowledge, few research has focused on stories developed and told by students and their effect on the learning experience. We extend this idea in our storytelling project (SP) by making the students economic storytellers.

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The Background of the Storytelling Project

The Storytelling Project (SP) consists of three assignments to be completed throughout the semester, culminating in a video presentation. The learning objectives, assignments, and examples are described in a workbook (see Appendix 1). The description and learning objective of the SP are presented to students during the first day of class. After approximately two weeks of class (after reviewing the concepts of GDP and unemployment), the first assignment is discussed in detail during class. In the first assignment, students collect historical data on unemployment rate and develop a graph. The data could be monthly or yearly unemployment rates in the USA, and the student choose the time-period (minimum of 5 years). Then, they write a clear and concise message about the data. For instance, students can create a graph of the yearly unemployment rate from 2005 to 2010 and write the following message "Economic recessions are associated with a higher unemployment rate. In the US economic recession of 2008, the unemployment rate reached 10.4%, a value well above the target unemployment rate of 5%." This first task involves multiple skills in Bloom's taxonomy, such as application, analysis, synthesis, and evaluation. The literature corroborates that collecting data and developing summary tables or graphs is effective at increasing analytical skills (Wuthisatian and Thanetsunthorn 2019). The student has approximately one week to complete this assignment. One hour of class can be used to show students how to collect the data in Excel and how to develop a graph. The workbook provides the steps on how to do these activities, including numerous examples, so students can meet the professor's expectations about the quality of the work. By using a grading rubric, faculty provides detailed written feedback on the quality of the graph and the message.

The second assignment consists of developing a short personal story (less than 200 words) using the three stages of storytelling: conflict, journey, and resolution (Bryant and Harris 2011; Choy 2017; Davidhizar and Lonser 2003; Goaz 2020; Knaflic 2015; Morgan et al. 2018; Srica 2016). This task puts the student in the role of a communicator who tells stories to connect with the audience and assist them in making sense of the data (Wolff et al. 2016). The story could be related to the data from the first assignment. For example, the student can describe the situation of family members who lost their job during the COVID-19 pandemic. The student has approximately one week to complete a first draft of the story. The workbook provides several examples of stories and their components. By using a grading rubric, detailed written feedback is given to students on the quality of their story.

The third and final assignment is a short video presentation (three to five minutes) combining the story and the message with a visually appealing graph or table. The video can be recorded using social media, TikTok, or any technology the students would like to use. The usage of videos and social media was a key element during COVID-19, and it is considered an effective experiential learning activity (Childers and Levenshus 2016; Gremler et al. 2000; Madden et al. 2016). The overall SP's objective is to improve students' written and oral communication

skills as well as higher cognitive processes when applying, analyzing, and evaluating data (Anderson and Krathwohl 2001). The SP also improves the class learning environment, participation, engagement, and motivation to learn.

Recognizing the difficulty at completing and evaluating the SP during the pandemic, the authors developed a workbook accompanying the SP that includes learning objectives, step-by-step on how to complete the three tasks, multiple examples, rubrics, and videos to set clear expectations about the quality of the work and to reduce the class time for instruction. Others have used workbooks in the classroom with positive results (Berntsen and Kristiansen 2019; Carlson and Winquist 2011).

Evaluating the Effectiveness of the SP

To measure the effectiveness of our experiential learning project (SP) at meeting the learning objectives, two commonly employed measures were used here: a performance assessment or test questions and a self-reported self-efficacy and attitude survey [see Gosen and Washbush (2004) for a review of the literature on assessing experiential learning activities in the classroom].

Written tests or quizzes are the most traditional method used to evaluate learning activities (Flores et al, 2015) and the most preferred assessment tool when teaching science and math subjects (Neumann et al. 2002). Following the literature, we developed four multiple-choice test questions that evaluate the level of analysis and understanding of macroeconomic data and graphs (see Appendix 3).

Regarding self-efficacy and attitudes toward a course or a topic, the literature predicts that cognitive competence, as well as motivation, and confidence, are directly linked to learning (Bandura 1977; Kearns 2012; Lauder et al. 2008; Schunk 1989; Zimmerman 2000). On average, motivated and confident students tend to excel in challenging courses (McCombs and Marzano 1990). Research also shows that students actively engaged in the course material put more effort and time into improving their cognitive strategies to complete a task (Linnenbrink and Pintrich 2003). Similarly, confidence in completing a task is related to self-efficacy or belief in one's own ability to learn, which reduces anxiety and stress (Bandura 1997; Pintrich and DeGroot 1990; Zimmerman 2000). In summary, engagement and motivation are linked to effort, and positive attitudes lead to learning (Kolb and Kolb 2005; Nyquist and Jubran. 2012; Zull 2006).

To measure engagement, motivation, confidence, attitudes, and anxiety after completing a learning experience, the literature is extensive in developing and using self-reported surveys (Bandura 1977; Chiesi and Primi 2009; Schunk 1989). Schau (2003) and Ramirez et al. (2012) used the Survey of Attitudes Toward Statistics (SATS) to evaluate (1) affect or feelings about performing a task, (2) cognitive competence or the perceived ability to complete a task, (3) value or the usefulness of performing a task, (4) difficulty or the anticipated burden of completing a task, (5) interest or the level of desire to perform the task, and (6) effort or the amount of work expected to complete a task. In these studies, college participants from introductory statistics courses completed the SATS, and these six indexes were constructed and evaluated. The authors found that more positive attitudes correlate

with higher course scores. In particular, cognitive competence, affect, and value were the statistically highest predictors of course engagement and understanding of the material.

In evaluating a portfolio curriculum among engineer students, Adair et al. (2018) used a pre- and post-test analysis with the SATS among two groups of students: those who completed a portfolio and those who did not. The portfolio consisted of records of reading materials, interactions with faculty and with other students, and individual work designed to encourage active learning and collaboration. The authors found that both groups significantly improved their cognitive competence, and both groups significantly overestimated the amount of effort needed to complete the course while significantly underestimating the difficulty of the coursework. Similarly, Pintrich and DeGroot (1990) used a self-report questionnaire from the Motivated Strategies for Learning Questionnaire (MSLQ) to evaluate motivation and self-regulated learning among 173 students. The MSLQ includes 56 items on student motivation, cognitive strategy, metacognitive strategy, and management of effort. These items are transformed into five learning indexes: (1) self-efficacy, (2) value, (3) anxiety (less), (4) cognitive strategies (plan for how to learn), and (5) self-regulation (reflect and modify). These authors find that higher levels of intrinsic value and self-efficacy are linked to higher grades across all types of tasks. Also, higher levels of test anxiety are significantly related to lower exam and quiz grades. A similar approach is observed in Lynch (2006), McClendon (1996), Pintrich et al. (1993), Soemantri et al. (2018), and Zhou and Wang (2021).

Based on the literature described above, we use a short version of the SATS and the MSLQ. In particular, following Pintrich and DeGroot (1990), Schau (2003) and Ramirez et al. (2012), we developed five indexes: (1) perceived cognition, (2) self-efficacy, (3) value, (4) anxiety (less), and (5) effort. Table 1 lists the five indexes with a brief description. Appendix 4 provides the survey and the statements linked to each index.

Carlson and Winquist (2011) used indexes to evaluate perceived cognition (Index 1), value (Index 3), and effort (Index 5) to determine the effectiveness of a workbook in an introductory statistics course. In the workbook, there were specific subsections and tasks for each statistical topic with increasingly complex conceptual and computational questions. At the end of the semester, the authors compared the group of 59

Table 1 SP effectiveness attitude indexes

Index (Question)	Title and description
Index 1 (Q7.1–Q7.2)	Self-Perceived Cognition: attitudes and perceptions about one's skills to perform a task.
Index 2 (Q7.3–Q7.6)	Self-Efficacy: belief in one's self to perform a task; related to confidence.
Index 3 (Q8.1–Q8.3)	Value: opinion about the importance of a task; related to motivation.
Index 4 (Q8.4)	Anxiety: feelings about performing a task, such as test anxiety.
Index 5 (Q8.5–Q8.6)	Effort: amount of work expected to use to perform a task; related to motivation.

See Schau (2003) and Pintrich and DeGroot (1990). Questions Q7.1 through Q8.6 are described in Appendix 4

students who completed the workbook against a control group of 235 students who did not. Overall, students who completed the workbook showed significantly higher values in perceived cognition, value, and effort compared to the control group. Students also showed more confidence in their ability to perform and understand complex topics and they enjoyed statistics more.

Adair et al. (2018) evaluated a portfolio curriculum approach by constructing five indexes from the SATS survey: (1) cognitive competence (six statements), (2) value (nine statements), (3) difficulty (seven statements), (4) effort (four statements), and (5) interest (four statements). They compared an experimental group or those completing the portfolio, and a control group or those who did not. Their results indicate that Index (1) increased in both groups, but was significantly higher in the experimental group. Index (2) or value for the subject decreased in the experimental group, but not significantly. Index (4) decreased in both groups, that is, both groups overestimated the amount of effort needed in the course. However, the overestimation was smaller in the experimental group, indicating that those students who were taught using the portfolio approach put more effort into the overall course than those who were taught under the traditional approach.

Pintrich and DeGroot (1990) also developed self-efficacy, value, and lower anxiety indexes. They find that self-efficacy and value are associated with higher scores on all graded classroom assignments, whereas lower anxiety is significantly related to higher exam scores. Similarly, Filippatou and Kaldi (2010) measured the effectiveness of project-based learning in a class with learning difficulties using self-efficacy and value indexes. They find that both indexes moderately increase after students complete a specific project. Aguilar et al. (2021) tested the effects of a flipped classroom style in an undergraduate management course using an attitude survey measuring self-efficacy, value, and anxiety. They find no significant difference in attitudes between the flipped classroom and the traditional lecture styles. Supported by the literature described in this section, we have developed an experiential learning activity and evaluated it using test questions and the five indexes described in Table 1.

Research Design

The SP and the accompanying workbook were developed in 2019 and implemented during the first two years of the COVID-19 pandemic (2020–2021) among college students registered in principles of macroeconomics courses at a mid-size private university in the USA. The courses were taught by two instructors. One instructor taught four sections, two sections using the SP and two sections without the SP. The other instructor led five sections, three with the SP and two without it. The sections with and without the SP were randomly selected. Each section had an average of 24 students. The authors completed IRB forms, which were reviewed and approved by the corresponding IRB committee before the implementation of the project and the survey.

The SP outcome is a 5-minute video presentation with three key components: A personal story to connect with the audience, a visually appealing display of the data,

and an explicit message. Students completed three tasks throughout the semester as graded assignments (see Appendix 1). The SP contributed 10% to students' course grades while exam scores weighed 10% more in the remaining sections without the SP. Appendix 2 shows the grading criteria used in both groups.

In assessing the effectiveness of the SP, we used a performance assessment through test questions and a self-reported self-efficacy/attitude survey. This survey consisted of 12 statements to build the five indexes described in Table 1. The survey was completed at the beginning and at the end of each semester among two groups: college students who completed the SP, defined as Experimental Group or EG, and college students who do not complete the SP, defined as Control Group or CG. In addition, all students in both groups completed four test questions at the end of each semester (see Appendix 3). All students from the EG completed the SP as a graded activity. All students from the CG did not complete the SP nor were they provided with any information regarding the SP. The experimental and control groups were randomly selected. No student in either group had to choose between completing or not completing the SP.

Data Analysis

Data Description

Table 2 presents a statistical summary by group and totals: 196 students participated in the experiment, from which 125 students were part of the EG and 71 students were in the CG. All nine sections had an average of 25 students enrolled in the class.

Table 2 Summary statistics per group

	SP EG	No SP CG	Total EG+CG
Total	125	71	196
(%)	(64%)	(36%)	(100%)
*Gender**			
Male	62%	48%	55%
Female	38%	52%	45%
Age	20.4	20.3	20.4
GPA	3.2	3.3	3.3
Year	1.86	1.79	1.82
Major			
Business	82%	75%	80%
Non-Business	18%	25%	20%

In Gender, we included "Other", but no participant marked this option. GPA is a self-reported GPA. Year is the academic year, where 1 = first year, 2 = sophomore, 3 = junior, and 4 = senior. Total number of observations is 196. *=t-test of equal mean with stat significance of 5%, **=t-test of equal mean with stat significance of 10%. Only gender produces significant differences at 10%

The average age of all students in the study was 20 years old; 55% were male students, whereas 45% were female students. Of the total, 80% were business major students, whereas 20% were non-business majors.

Table 2 shows that both groups, EG and CG, are statistically similar in terms of demographics. For instance, the average age of the EG was 20.4, and the average age of the CG was 20.3. In both groups, about 80% were first and second-year students. Most students were business majors (80% in the EG and 75% in the CG). The only statistically significant variable is gender. There were 62% male participants in the EG (and 38% female participants), compared to 48% male participants in the CG (and 52% female participants).

Results

The effectiveness of the SP on cognitive and performance competencies was evaluated through test questions. These questions are related to economic data and graph analysis and interpretation (see Appendix 3). We completed equal-mean tests to corroborate that, on average, the difference in grades per group are statistically different. Figure 1 and Table 3 show the test results by groups and the equal-mean tests by question. On average, students completing the SP (EG), correctly answered the four questions more often than students who did not complete the SP (CG). For example, question 2 (Q2) was completed correctly by 83% of the students in the EG, while only 60% correctly answered this question among CG. The difference is 23 percentage points (f-value=4.13 > f-crit=4.04, p-value=0.047). Similarly, question 3 (Q3) was answered correctly by 93% of the students in the EG, while this value was only 75% among students in the CG (f-value=4.47 > f-crit=4.04, p-value=0.039). Finally, question 4 (Q4) was correctly answered by 97% of the students in the EG, while this value was only 85% among students in the CG (f-value=5.08 > f-crit=4.04, p-value=0.029).
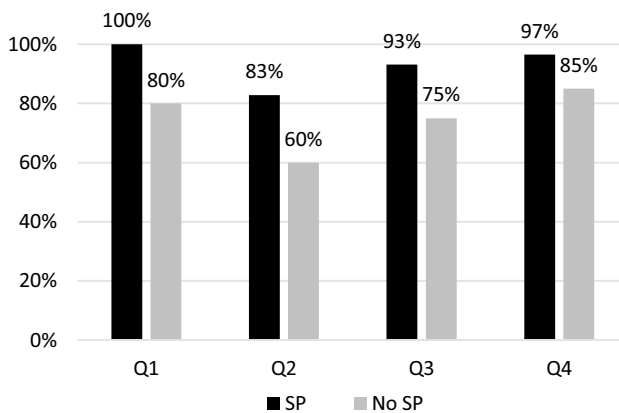

Fig. 1 Test Results by Groups. *Note* Total number of observations 50. All students completed the test questions, but the investigators were able to collect only 50 out of the 196 tests. Test questions are presented in Appendix 3

Table 3 Exam results: equal-mean tests

	Percentage point difference	*f*-value	*f*-critical	*p*-value
Q1	20	8.70	4.04	0.005
Q2	23	4.13	4.04	0.047
Q3	18	4.47	4.04	0.039
Q4	12	5.08	4.04	0.029

Correct answer = 1, incorrect answer = 0. Percentage point difference = Difference between correct and incorrect. Equal-means tests show that the grade-differences between groups is statistically significant at 5%

The second assessment tool used in this study to evaluate the effectiveness of the SP was based upon well-known self-efficacy and attitude surveys (Adair et al. 2018; Schau 2003; Pintrich and DeGroot 1990) with 12 statements that were converted into five indexes described in Table 1. Table 4 shows the comparative results of the indexes by groups. All indexes show statistically significant variation from the beginning to the end of the course per group, corroborating the results in Adair et al. (2018) and Carlson and Winquist (2011).

Index 1, or the Self-Perceived Cognition Index, evaluates the attitudes and perceptions about one's skills to perform a task. This index significantly decreases in both groups, as the score moves closer to "agree" from "strongly agree," indicating that on average, students overestimate their ability and skill levels to understand economics (Nowell and Alston 2007). Such overestimation was adjusted at the end of the semester, more so among students in the EG. (CG changed from 4.3 to 3.9 and EG changed from 4.5 to 3.9 in Table 4).

Index 2, or Self-Efficacy Index, provides evidence of the student's previous knowledge of economics and their confidence to apply that knowledge in the course. This index significantly increases in both groups, showing that students feel more confident regarding economic concepts and data analysis after

Table 4 SP effectiveness indexes

Index	CG Start	CG End	Diff	EG Start	EG End	Diff
Index1: Self-Perceived Cognition	4.3	3.9	−0.4*	4.5	3.9	−0.6*
Index2: Self-Efficacy	3.5	4.1	0.6*	3.6	4.1	0.5*
Index3: Value	4.2	3.9	−0.3**	4.3	4.0	−0.3**
Index4: Anxiety	2.8	3.7	0.9*	2.9	3.7	0.8*
Index5: Effort	4.7	3.8	−0.9*	4.8	4.4	−0.4*

Description of the indexes is presented in Table 1, 5 = Strongly Agree (maximum value), 4 = Somewhat Agree, 3 = Neither Agree nor Disagree, 2 = Somewhat Disagree, 1 = Strongly Disagree (minimum, value). Observations at the start of the semester = 209. Observations at the end of the semester = 196. The difference in observations is due to students dropping the course or not completing the end of the semester survey. *=*t*-test of equal mean with stat significance of 5%, **=*t*-test of equal mean with stat significance of 10%

completing the course. Similar results are observed in Filippatou and Kaldi (2010) and Pintrich and DeGroot (1990). Nonetheless, there is no substantial difference between groups (CG's value increased from 3.5 to 4.1 and EG's value increased from 3.6 to 4.1 in Table 4).

This result indicates that after completing an economic course, students feel more confident about their understanding of economics, independently of completing the SP. Index 3, or the Value Index, measures student motivation to learn economics. This index decreases in both groups at a similar rate (CG's value decreases from 4.2 to 3.9 and EG's value decreases from 4.3 to 3.9 in Table 4). This is not surprising, albeit somewhat disappointing. Students find that the knowledge they gained was less useful than they originally thought, corroborating similar results in other studies (Adair et al. 2018).

Index 4, or the Anxiety Index, shows that in both groups, EG and CG, students experienced a reduction in anxiety when completing the coursework (a higher index value is linked to lower stress levels). The EG shows a greater reduction in anxiety than the CG, consistent with the results in Pintrich and DeGroot (1990). That is, the experiential activity of the storytelling project improves self-confidence and reduces anxiety and stress in economics courses.

The difference between beginning and end of the semester for the Index 5 was −0.9 for the CG group, while for the EG group was only −0.4. This index provides evidence of the expected work the student will commit to the course (for example "I don't plan on missing any classes in this course") and the actual work the student completed, i.e., the student actually missed classes. That is, at the beginning of a semester, all students expect to invest considerable effort in the course (both groups show a value close to 5 out of 5). At the end of the semester, the actual effort put into the coursework is significantly less, corroborating the results of Carlson and Winquist (2011). However, students in the EG show higher effort at the end of the semester than students in the CG (4.4 versus 3.8 in Table 4), evidencing the successful motivational effect of the SP to complete all classwork.

In summary, students in both groups, EG and CG, show improvements in self-efficacy and less anxiety after completing the course. However, the students in the EG show a deeper recognition of the level of difficulty of the course and more motivation to complete the classwork than the students in the CG.

Our results indicate that experiential learning activities in economic courses can improve self-efficacy and effort to complete tasks, quizzes, and classwork. However, our study also shows some limitations that must be addressed in further research. First, the sample size was too small for a complete reliable regression analysis or statistical analysis between groups. Second, the test questions were not linked to the self-efficacy and attitude survey results, precluding us from completing a regression analysis using test questions data as control variables. Finally, the experiment was implemented in 2020–2021, during the COVID-19 pandemic and its devastating effects on the mental and physical health of the college student population (Savage et al. 2020; Wang et al. 2020). Our results should be compared to future school years, where the pandemic's harmful effects should be significantly reduced. Finally, we did not statistically

evaluate the effectiveness of the workbook and its components, but just the overall SP in the classroom. The limitations described here will be addressed in an upcoming research paper.

Conclusions and Recommendations for Future Research

Data analysis and data presentations are professional skills in high demand. Thus, our ultimate goal as educators is to develop literate adults who appropriately use data analysis and graphs to convey ideas to others. To improve these skills among college students, we have designed an experiential learning activity, defined as the Storytelling Project or SP, consisting of collecting complex economic data, developing and presenting graphs, and at the same time, connecting with their audience by sharing a personal story. The SP with the workbook were implemented during the first two years of COVID-19 (2020–2021). Students in nine principles of macroeconomics courses in a mid-size private university in the USA. participated in an experiment consisting of two groups: those who completed the SP using the workbook, and those who did not. Test scores and self-efficacy were compared between these two groups. In total, the experiment included 196 participants with similar demographic characteristics.

We evaluated the effectiveness of the SP by using a performance assessment or test questions and a self-reported self-efficacy and attitude survey. Our results indicate that students who participated in the SP by developing their own personal stories have a better understanding of economic data analysis and put more effort into the classwork. The SP also promotes a more confident and engaged student and improves soft skills, such as oral communication.

The SP provides systematic and efficient criteria to evaluate and present complex economic data. It can be administered within a manageable time inside and outside the classroom. Due to the development of the workbook, the SP also can be implemented in online courses. The SP can improve course grades and students' engagement and effort in economics as well as other data-driven topics. The literature supports the effectiveness of the storytelling approach to retaining information and gaining a deeper understanding of academic material.

The research completed here points to other areas for further investigation. First, the impact of COVID-19 and its effects on effort, anxiety and self-efficacy among college students is a topic of relevance. The evaluation of the workbook to improve students' self-reliance at learning new material also invites further investigation.

Appendix 1: Workbook Sections: Learning Objectives and Assignments

"What is your story?" Presenting Economic Data with a Story

Objective: This workbook provides guidelines on how to develop a compelling and interesting story around complex economic data, and present that data effectively, and visually appealing, to an audience. It provides the principal elements of storytelling and data visualization, with examples of the do's and don'ts for developing each in a business environment.

The workbook is divided into three parts that will be completed throughout the semester. **Part 1** provides instructions and examples of how to analyze economic data and create a message from the data. **Part 2** gives steps-by-step instructions for developing a story to connect with your audience and how to combine your story with your message and data. **Part 3** demonstrates how to effectively communicate your story, message and data, and how to make your presentation eye-catching.

Learning objectives

After completing all the assignments in this workbook, you will be able to:

Part 1: Analyzing Economic Data

1. Identify trends, patterns or outliers from large datasets using tables or graphs.
2. Develop a message about the trends or outliers using economic theory.

Part 2: Developing your Story

3. Recognize the three key elements of a good story.
4. Develop a short story to captivate an audience.
5. Connect your story to your message and data.

Part 3: Presenting your Data with a Story

6. Communicate complex data effectively to an audience.
7. Give a visually appealing presentation using data visualizations.

Introduction: Telling a story when presenting data

Why do we want to tell a story when presenting data? The simple answer is to help your audience relate to complex information. One of these days, you will apply for a job, report data to a Board of Directors or pitch your idea to potential financial backers. In any of these cases, you are going to compete with other candidates. What will make you stand out? A good story!

In a competitive environment, storytelling increases the likelihood that your audience will retain your message, the point you are trying to make. A well-developed story reveals your abilities to communicate effectively. Why? Because a story connects you with your audience, especially when presenting complex data…

HW 1: "Analyzing Economic Data"

Task: Analyze macroeconomic data by creating a graph, looking for trends or patterns, narrowing your focus, and creating a message.

Instructions: …

HW 2: "Developing Your Story"

Task: Develop a story based on a personal event. Consider how the story will relate to your audience (your classmates), and how the story will connect to your message and data.

Instructions: …

HW 3: "Presenting Your Data with a Story"

Task: Develop a PP slide using data visualization to display your message and data. Then create a video presentation, telling your story and showing your slide. Remember to make your slide visually appealing and your presentation memorable.

Instructions: …

Appendix 2: Grading Criteria Described in the Syllabus

EG Syllabus:

Course Evaluation

- Online concept quizzes ………………………………………………… = 10%
- Online homework ……………………………………………………… = 10%
- Storytelling Project Activity: Analyzing Macroeconomics Data …………. = 10%
- Five exams (final test is optional) ………………………… …..………… = 70%

　　　　　　　　　　　　　　　　　　　　　　　Total　　= 100%

Notes on Class Participation, Grading and The Storytelling Project

- …
- The Storytelling Project (SP) represents 10% of your grade and is described in a document defined as the "The SP Workbook" (BB/Course Content/SP). In this document, you can find the learning objectives for this class activity, a step-by-step on how to complete the assignments, and many examples and videos. The SP has three assignments to be completed throughout the semester. Each of these assignments is linked to a grading rubric. Please, review the rubric before submitting your work. All assignments will be submitted on BB.

CG Syllabus:

Course Evaluation

- Online concept quizzes ………………………………………………… = 10%
- Online homework ……………………………………………………… = 10%
- Five exams (final test is optional) ………………………… …..………… = 80%

　　　　　　　　　　　　　　　　　　　　　　　Total　　= 100%

Appendix 3: Test Questions

1. Refer to Figure 1. Between 2008 and 2010, the solid line and the dashed line moved in opposite directions because:
   a.   during that time, a recession caused real GDP to decrease and unemployment to increase.
   b.   the economy was experiencing economic growth, increasing real GDP and decreasing unemployment.

   c.   during that time, a recession caused real GDP and unemployment rate to decrease.
   d.   the unemployment rate increased which caused inflation to decrease.

2. Refer to Figure 1. Between 2008 and 2009, the unemployment rate:
   a.   increased about 10%.
   b.   decreased about $400 billion.
   c.   decreased about 5%.
   d.   increased about 5%.
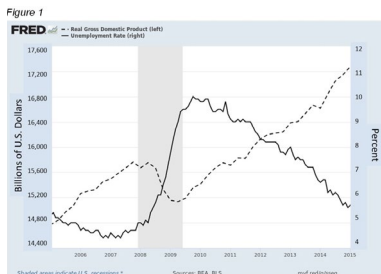
Figure 1

3. Refer to Figure 2. Between 2018 and 2019, the highest unemployment rate was observed in:
   a.   New York
   b.   Florida
   c.   The United States
   d.   Both, New York and Florida

4. Refer to Figure 2. Between 2015 and 2016, the greatest change in unemployment rate was observed in:
   a.   New York
   b.   Florida
   c.   The United States
   d.   Both, New York and Florida

Figure 2 Unemployment Rate, source: BLS.gov

Year	United States	New York	Florida
2015	5.0%	4.9%	5.2%
2016	4.9%	4.9%	4.8%
2017	4.1%	4.7%	4.0%
2018	3.8%	3.9%	3.4%
2019	3.6%	3.9%	2.9%

Appendix 4: Self-Efficacy and Attitude Survey

Q7.1. I am certain I can understand the ideas taught in economics.   SA SMA N SMD SD
Q7.2. I am sure I can do an excellent job on the problems and tasks assigned in this course.
Q7.3. I think I know a great deal about economics.
Q7.4. I can easily understand economic data and graphs.
Q7.5. I can easily explain economic data or graphs to someone else.
Q7.6. I can easily discuss current economic events with others.
Q8.1. Economics will be useful to me when I discuss current issues with someone else.
Q8.2. I am interested in discussing current economic issues with someone else.
Q8.3. I am excited about taking this economics course.
Q8.4. I experience less anxiety about economics courses.
Q8.5. I don't plan on missing any classes in this course.
Q8.6. I plan to put in the effort to do well in this course.

SA—strongly agree, *SMA*—somewhat agree, *N*—neither agree nor disagree, *SMD*—somewhat disagree, *SD*—strongly disagree

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