Special Research Article

Visioning the Future: Evaluating Learning Outcomes and Impacts of Futures-Oriented Education

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Abstract

In a world of continuous change, fostering futures thinking in the education system has been recognized as a preferred and effective outcome to transform the current factory learning orientation into a culture of foresight. A lack of quantitative research on the measurable outcomes of futures learning seems to discouraging its development in the community of higher education. To fill the gap, this research conducted an empirical examination to evaluate the outcomes and impacts of Tamkang University's future-oriented education; with a quantitative survey of 578 valid samples collected. This study applies the technique of factor analysis with five dimensions of futures thinking were identified: change agent, transdisciplinary system, long-term thinking, concern for others and openness to alternatives. The results indicate that students who have taken futures courses demonstrate statistically significant higher performance in two dimensions of futures thinking, namely transdisciplinary system and openness to alternatives. Additionally, they are more optimistic toward the year 2030. Male students exhibited significantly higher levels of change-agent futures thinking than that of female students. Freshmen, students of the business college and those less active in club activities exhibited lower performance in three dimensions of futures thinking. The initial results should bring guidance for other similar educational institutes that may consider following the path of futures-oriented pedagogical design.

Keywords

Visioning, Futures Thinking, Quantitative Research, Evaluation

> All education springs from images of the future and all education creates images of the future. Thus all education, whether so intended or not, is a preparation for the future. Unless we understand the future for which we are preparing, we may do tragic damage to those we teach. Unless we understand the powerful psychological role-played by images of the future in motivating- or de-motivating – the learner, we cannot effectively overhaul our schools, colleges or universities, no matter what innovation we introduce. (Toffler, 1974, p.19)

Introduction

Evaluation is another form of learning. It provides information that maximizes the desired impact of foresight while deepening reflection about the process of the project itself (Gardner & Bishop, 2019). Tamkang University's futures-oriented education has an ambitious vision to not only equip students with futures literacy in anticipating future changes but to have the agency to create those future changes, with the intelligence and courage to make things happen for the tomorrow that we expect to have. While the university is aware that evaluation is a useful activity for reaching better standards of teaching and learning, evaluations done to date have been limited to teaching and program performance, not to subject efficacy. Evaluation is a useful activity for fostering young futurists and not just teaching itself. Professors who engaged in teaching courses should be curious to know answers to the questions: "Does my teaching make a difference in how students think about and plan for the future?" "Are my students really

developing their futures orientation as well as long-term thinking when confronting disruptive changes?" and "Do the young students develop futures capacity and are they willing to take complex positions on emerging issues?" Recently, futurists from different organizational settings, such as education, business and policymaking, have started to stimulate the emerging trend of evaluation.

Hicks and Gidley (2012) organized a special issue of *Futures* collecting a diverse range of papers from the international field of futures education, ranging from very young children to universities. They specifically aimed to explore the field of futures education from three main constituent parts: youth futures, futures in education and futures of education. For the first two parts, Hicks (2012) found that encouraging teachers to develop a futures perspective in their own curriculum area may be a more constructive way forward than trying to promote futures education as a separate entity. Hutchinson and Herborn (2012) explored the value of an experiential futures activity relating to environment and peace through a guided urban walk in Sydney. Nasruddin, Bustami and Inayatullah (2012) offered a case study of futures studies in higher education and concluded with an analysis of USM's current position, in transition between the contestation and dynamic equilibrium stages. The studies have reached a good consensus that educators should help young people to feel empowered in relation to their future and future change. It is the duty of educators in all levels of educational settings to stimulate futures thinking to the present generation of learners.

From the perspective of futures of education, a notion of long-term thinking and foresight is embedded in the underpinning educational philosophy. Also in the year 2012, Patrick Van Der Duin and Steen Van Der Martin formed a special issue of *Futures,* aimed at examining futures research's quality, success and impact and to determine what we can learn from them. They found that conducting futures research alone is not sufficient to produce good and usable results. However, with six futures research articles, they found it necessary to ask futures researchers to make a contribution to this area, because we still need more knowledge to improve the theoretical foundation and practical application of the evaluation of futures studies.

More recently, *World Futures Review* published a special issue on expanding foresight evaluation capacity. The focus was on the use of the evaluation tools used by futurists, particularly the application of evaluation principles and methods used by futurists in education, organizations, and policymaking (Gardner & Bishop, 2019). The editors have contributed greatly to further fill the gap between futures works and evaluation. Tamkang University, as an educational organization as well as a learning community, may benefit deeply by their efforts from the organization to program and curriculum design. First of all, aside from their exhaustive review of the evaluation literature, Vataja, Dufva and Parkkonen (2019) illustrated Sitra's (the Finnish futures fund) futures work in three theme areas: the capacity for societal renewal, the transition to a carbon-neutral circular economy, and the creation of new working life and a sustainable economy. These visionary goals will help societies moving from emerging economies to post-capitalist societies. Gary's (2019) work on foresight training: moving from design to evaluation provided practical uses of interactive training programs to equip practitioners in the use of defined foresight competencies. The four levels of Kirkpatrick evaluation model, namely reaction, learning, behavior, and results, should help futures studies programs at graduate level sustaining for the long haul.

Mengel's (2019) research on learning portfolios as a mean of evaluating futures learning-a case study at Renaissance College provided a multifaceted evaluation design to assess undergraduate learner outcomes with foresight thinking applied. Three positive outcomes and feedbacks are reached: 1) assessment and evaluation played a major role in futures learning, and the learning portfolio based on relevant learning outcomes were an effective means of assessing student learning and of evaluating the effect of futures learning; 2) adding futures learning more explicitly to the integrated studies approach effectively fostered student learning; 3) many learners express increased confidence over time in being prepared for whatever any future may hold. Following what Mengel suggests that broader and possibly more comparative research projects are need to address questions beyond the scope of individual case studies, the results from this research will further enrich the learning assessment and enhance the interest of futures learning.

The authors started assessing the learning outcome and impact of adding futures thinking into the future-oriented pedagogy and curriculum design within the sector of general education. Inayatullah and Chen's (2006) research on futures images of university students found that students are taking a relatively practical approach to link the world and are aware of the potential economic and political threats from China. Most importantly, the students have also started to demonstrate the phenomenon of generational replacement and ask to give youth a voice at the decision-making table. Their vision of the future was to see the future as evolving and thus continuously explore alternative

futures, and link these futures to strategy and day-to-day outcomes. When further research conducted to explore values of high-school students a decade later in 2016, the young students exhibited a deeper sense of global awareness, foresight capacity and their role as a change agent for a better future. Their preferred stories of the future involve an open and global environment, broad and diversified friendship, leisure and travel over work, family and relationships, and a multicultural as well as collaborative behavior (Chen, 2016).

Liu and Lin (2016) also found that many Taiwanese students would like to see a future based on greater environmental awareness and actions involving techno-scientific advancements. Moreover, their findings suggested that students desire better environmental quality (e.g. clean air and water), presence of nature, and the use of harmonious technologies (e.g. green energy, underground transportation systems) in support of comfort and livability, including positive attitudes regarding environmental factors such as trees over buildings, global warming awareness, and alternative energy sources. Liu (2019) concluded that, as the incorporation of futures thinking in science and environmental education remains relatively under-examined, more research along these lines is needed to provide the basis for curricular and instructional development.

Prior to Mengel's research (2019), Kelly (2006, 2010) had applied reflective journals as a core pedagogical intervention. Kelly's work gathered constructive insights that students' actions and attitudes in a tertiary educational system are transferable to a less economically driven, peaceful and spiritually oriented way of living. Chen and Hoffman (2017) also have successfully enhanced the learning outcome by applying an experimental and innovative game-based design in future's general education course. Chen (2019) expanded the research of evaluating sustainability-oriented foresight education as a transformative intervention for societies genuinely seeking to create economic and ecological well-being for future generations. Students of the course "Environmental Changes and Sustainable Futures" were the participants in a quasi-experimental research design with pre- and post-measurements, and using participatory learning, reflective journals, and scenario workshops as the tools of pedagogical intervention. The results suggest that through a process of integrative learning, a culture of forward-thinking and visioning for sustainable alternative futures is emerging.

However, there still exists a gap between evaluating futures of education (views of the future) and evaluating futures in education (teaching and learning). Stated differently, there is a lack of research providing measures that can be used consistently across other similar disciplines. Gary (2010) has demonstrated great ways for new disciplines to integrate foresight into their practice, as Regent University has done for leadership studies. In addition, that experience also relates to outcome assessments that generate students' interests in learning futures and foresight. Hines, Gary, Daheim, and van der Lann (2017) developed the APF Foresight Competencies that measures futures literacy from the education arena, and application of a logic model to help determine these outcomes, methods, and measures for a specific foresight initiative. To assess what really works in futures studies, Inayatullah (2020) developed a conceptual framework, an insight and case-study based stage theory of the uses of the future. He believes that the role of the futurist, the foresight practitioner, is to determine given the worldview of those involved in the process, what is the most appropriate iteration of interventions.

Measuring Futures Thinking

While we have well entered into the 21st century for two decades, the argument that the economic rationalism underpinning contemporary educational and social policy still considers secondary and tertiary education to be training for future employment, in spite of the fact that most of this employment no longer exists (Ross, 2016). The current generation of youth in Asia is better educated than before, but the jobs matching the skill level of a high educated workforce are not always there and young people's pathways into work are changing (Naafs & Skelton, 2018). A government-led educational system still holds the industrial worldview that to stay globally competitive requires flexibility and reduced labor costs, which diminishes young people's futures orientation and their possible futures (Gordon, 2017; Lukacs, 2015). In the face of all these socio-economic stressors and related symptoms, a transformed worldview of alternative futures is essential. Doing so means innovating; forecasting emerging technologies; escaping from the confines of economistic strategic thinking, and making serious use of the tools Futures Studies has to offer.

It is important that Tamkang University's approaches to educational futures take into account the new thinking patterns and ways of knowing that have been emerging. Gidley (2012) has proposed that these changes, which have

been affecting all disciplines and fields of knowledge, require that education begin to embrace what she called evolutionary pedagogies. What Gidley called 21st century evolutionary pedagogies includes futures & foresight, ecology & sustainability, wisdom, complexity, imaginative, creative, social & emotional, spirituality, holistic & integral, aesthetic & artistic, postmodern & poststructuralist, and critical & postcolonial education. At Tamkang, this meant establishing a consensus of pedagogical approaches for all futures related courses, around eighty classes per academic year, taught by twenty-five professors from various disciplines. Trends and foresights of five major drivers of change in Society, Technology, Economy, Environment and Politics are the main electives. Inayatullah (2001) further generated from workshops with 108 futurists that the following shared assumptions needed to be part of the curriculum: (1) Understanding we are in the midst of a historical transformation. Current times are not just part of normal history, (2) Multiple perspectives are at heart of futures studies, (3) Consideration of alternatives and being aware of multiple possibilities, (4) Participatory futures, (5) Long-term policy transformation, (6) Trans-disciplinary approaches that seriously embrace complexity, (7) Motivated by change and desire an active role in world transformation, (8) They are hopeful for a better future as a "strange attractor", (9) Futurists have a long term perspective, (10) Sustainable futures. Sustainability is not a "back to nature" ideal, but rather inclusive of technology and culture.

Chen (2011) conducted a three-round Delphi survey using these shared assumptions and further found that the major dimensions of futures orientation courses should include:

1. Recognizing, adjusting, and creating the future
2. Cultivating visions and senses of the future
3. Establishing a world view with an attitude of caring and participating
4. Developing an acute sense of observation
5. Questioning authority and being a critical thinker questioning known facts
6. Giving insight into long-term trends
7. Adapting to the team-based and interdependent working relations
8. Becoming familiar with knowledge of advanced technological products
9. Being concerned with the potentials and impacts of future technologies
10. Caring for the future welfare of minority groups
11. Respecting diverse viewpoints on alternative futures
12. Advocating the essentiality of transdisciplinary and multicultural approaches

Accordingly, students equipped with concepts of futures orientation can be defined as having the following qualities: (1) A long-term perspective, (2) Change agency, (3) Alternative Futures, (4) Trans-disciplinary approaches that take complexity seriously, and (5) Focuses on ways of knowing. In their recent study, Ahvenharju, Minkkinen and Lalot (2018) contend that futures research studies and builds images of possible, probable and preferable futures and paths to such futures. They generated five dimensions of futures consciousness after a thorough literature review from a long list of futures-related characterizations since the 1970s. They found that despite the importance of the concept of futures consciousness, and the proliferation of related concepts, there is no commonly used definition of operationalization that would permit empirical research. The conceptual model of futures consciousness contains five dimensions: (1) Time perspective, (2) Agency belief, (3) Openness to alternatives, (4) System perception and (5) Concern for Others. The design of research questions concerning futures thinking for this study has adopted concepts and characteristics from all of this previous research.

Methodology

The quantitative data used in this research was collected in the academic years of 2018-2019, through surveys of futures thinking and futures literacy. The survey is constituted by four parts: (1) twenty questions on futures thinking, (2) fourteen questions on supposed versus preferred future of Taiwan in 2030, (3) sixteen questions on emerging STEEP futures 2030, including one multiple-choice question on metaphor of the future, (4) five questions on demographic background. A total of fifty items was included in measuring concepts related to futures thinking.

The first part questions used a 4-point Likert scale, scored from 1 (totally disagree) to 4 (totally agree). The reliability of the 20 items was tested by using Cronbach's alpha, which showed a satisfactory level of internal consistency (alpha=0.72); a reliability coefficient of 0.70 or above is usually considered acceptable (Taber, 2018).

The student respondents' age ranged from 18-23 years old with a balanced gender ratio (male/female: 46.3/53.7). A total valid sample of 578 was gathered for this initial analysis. A higher percentage of freshmen (41%), relative to 16 percent sophomore, 16 percent junior and 27 percent senior. Most of them are from college of business and management (58%) and engineering (19%), while college of literature, foreign language, international affairs and education altogether counts only 23 percent of the sample. Nearly 60 percent of them have taken at least one futures course and most of them are active in club activities (69%).

Results and Discussions

To empirically examine the construct of futures thinking in the first part of the questionnaire, two statistical procedures has to be applied to the 20-item survey. The Kaiser-Meyer-Olkin Measure of sampling adequacy (KMO) is a statistic that indicates the proportion of variance in your variables that might be caused by underlying factors. High values (close to 1.0) generally indicate that a factor analysis may be useful with your data. If the value is less than 0.50, the results of the factor analysis probably won't be very useful. The 20-item survey has shown a KMO value of .847 (p<.01) and proved to be a reliable data for applying factor analysis.

These 20-items questions are uniformly in Likert-Scale design, a four-point indicator ranging from "Strongly Agree to Strongly Disagree." Some questions are deliberately stated in negative tone to ensure that all the answers correctly respond to its original objective. According to the results, the students have a clear sense of what they should do and how to prepare for the future. Indeed, their qualities of positive and proactive vision of future-oriented thinking generally surpass traditional elites. Particularly, they are strongly interested in planning the future and making changes in institutions, organizations and responsible groups. They also firmly believe in creating alternative futures rather than following destiny.

The responses are further categorized into five major utilizing factor analysis (see Table 1 below). Principal component analysis (PCA) was used to extract factors from the 20 items with eigenvalues set to as 1.0 or higher. Five factors were obtained and they accounted for 53.45% accumulative variance. All five factors met the 5% and above criteria, with variances of 20.69%, 15.52%, 6.49%, 5.72%, and 5.04% of the variance.

Five major factors are identified as follows:

Factor 1: Change Agent
The first factor explains 20.69 percent of the variance. This factor was named and interpreted as "change agent." It indicates that the students take complex positions on issues, and attempt to use the future to change the present problems. The capacity requires a well-informed theory of social change in which change is considered possible, that is, agency is possible. In addition, the future is optimistic, that is, good futures can be created. The study suggested that students could see themselves as active agents who can exercise their action and influence towards shaping the future.

Factor 2: Transdisciplinary system
The second factor explains nearly 16 percent of the variance. Young students were born at a time when change-technological, cultural, spiritual, global-is endemic. Crises are no longer local but have the capacities to alter the future of the planet, indeed, human evolution or devolution (Inayatullah, 2004). Futures-orientated education thus to succeed needs to be trans-disciplinarian, using insights from social and cultural studies, economics, psychology, global governance, design thinking, environmental studies, robotic engineering and other fields to help create a different, better world for all.

Factor 3: Long-term thinking
The third factor explains 6.5 percent of the variance. Long-term thinking means moving from the day-to-day operational considerations of management to the longer-term transformative dimensions of leadership. Much of the

tradition of psychological future-orientation research has focused on how far an individual plans their future or how far their images of the future reach (Beal, 2011). Hence, it is the connectivity to the common vision. Forward-thinking is applied to seek visualizing the preferred future of individuals and organization/states. By focusing on a desired future, it creates a strong pull, a move toward a different world. As Inayatullah (2001) claimed that the vision acts as a strange attractor, helping societies move away from the current to a different future.

Factor 4: Concern for others
The fourth factor is the notion of inclusion and explains 5.72 of the variance. Given that the future is foggy, hard to see, included as many stakeholders as possible is likely to increase the efficiency and efficacy of the foresight project. More voices tend to make the future more robust. Many futurists share the idea of aiming towards a better, or a preferable future, instead of just observing the development towards the future. Bell (2004) proposed nine major tasks of futures studies and he claimed that the study and fostering of deep caring about the freedom and welfare of future generations are among the most important purposes of futures studies. Thus, this dimension emphasizes the capacity for being concerned about and committing oneself to bettering not only one's own future, but the future of others (Ahvenharju et al., 2018).

Factor 5: Openness to alternatives
The fifth factor explains 5.04 percent of the variance. Openness to alternative futures means flexibility in decision-making by moving from a focus on one future to an analysis of alternative futures. The result suggests that students constantly question not just their values and empirical positions about the nature of the world, but the paradigms that inform their positions. They are integrated, seeing the links between the external world and the internal world, individual and society. It combines several characterizations of creativity, imagination, critical thinking and openness, and it is strongly linked to the capability if embracing and appreciating change, seeing the value of alternative ways, and questioning established truth (Ahvenharju et al., 2018).

Table 1: Factor analysis of futures thinking construct

Items	Factors				
	1	2	3	4	5
13. Share ideas on change	.781				
14. Apply futures thinking	.777				
15. Confidence in futures development	.706				
12. Adopt diverse perspectives	.704				
11. Change is constant	.605				
16. Sacrifice now for future	.578				
09. Trust ourselves more than unknown forces		.745			
07. Planning is useful		.726			
10. Plan beyond fate and destiny		.723			
17. Prepare futures outside business as usual		.707			
03. Don't rely on leaders and experts		.420			
19. Long-term goal is important			.732		
20. Accept challenge for desired future			.592		
18. Proactively follow inner values			.555		
01. Devote life to ideal				.667	
05. Moral qualities count				.660	
04. Success of children				.546	
06. One knows right and wrong					.687
02. Tolerate difference of opinions					.536
08. Can make a difference					.409
% variance explained	20.69	15.52	6.49	5.72	5.04

To further probe into the research questions of this study, statistical procedure of comparing means scores (T-test for dichotomous demographic variables and ANOVA for multiple categories of variables) of dimensions of futures thinking are applied. Table 2 shows the results that male students exhibits significant higher level of change-agent futures thinking than that of female students (3.09/2.97, t=3.73, p<.01). As Taiwan becomes wealthier with increasing gender equity in educational and job opportunities, young female's role in transforming the social futures remains emerging. Chou (2018) found that while the vitality and versatility of women's movement were gradually appreciated in Taiwan; however, in terms of the acceptance and prevalence of gender studies as an independent academic discipline remains much to be desired by feminist ideals. Students who are active in club activities tend to show significant higher score (3.09/2.98, t=2.15, p<.01) in the futures dimension of transdisciplinary system. It is noteworthy to mention that the course of "learning and practice of clubs" has been designated as one of the required courses in general education. Practices and activities outside classroom and campus have gained its importance due to a rising appreciation of multicultural and holistic thinkers (Heinonen, 2013).

Table 2: Comparisons of futures thinking by socio-demographic characteristics

| | T-test statistics (two-tailed test) | | | | | |
| Factors | Gender (M/F) | | Club Activity(Y/N) | | Futures course taken (Y/N) | |
	Mean	t.	Mean	t.	Mean	T
Change Agent (F1)	3.09	3.73**	3.04	1.36	3.03	.383
	2.97		2.99		3.02	
Transdisciplinary system(F2)	3.02	-1.30	3.09	2.15*	3.15	5.73***
	3.08		2.98		2.90	
Long-term thinking(F3)	3.11	.655	3.10	-.251	3.13	1.60
	3.09		3.11		3.07	
Concern for others(F4)	2.69	1.24	2.66	-.226	2.63	-2.08*
	2.64		2.77		2.71	
Openness to alternatives(F5)	2.78	-1.48	2.83	1.47	2.88	4.74***
	2.83		2.77		2.71	

*p<.05; **p<.01; *** p<.001

The most important research question is: do students who have taken at least one futures courses demonstrate higher performance in terms of each factor mean scores than those who haven't? The results show two strong positive/significant feedbacks from the dimensions of transdisciplinary system (3.15/2.90, t=5.73, p<.001); as well as openness to alternatives (2.88/2.71, t=4.74, p<.001). While it also shows a slight negative difference in the dimension of concerns for others (2.63/2.71, t=-2.08, p<.05). The findings are encouraging not only supporting the University's futures-oriented objective, but motivating professors who have been engaging in teaching and learning futures with students.

Table 3: One-way ANOVA analysis of futures thinking by class

Factors	Class	Mean	SD	Sources of Variance	SS	MS	F	Sheffé post hoc multiple comparisons
F1	(1)freshmen	3.02	.425	BG	1.221	.610		(3)>(2)
	(2)2+3	2.98	.378	WG	90.562	.157	3.889*	
	(3)senior	3.10	.371					
F2	(1)freshmen	3.02	.425	BG	8.482	4.241		(2)>(1)
	(2)2+3	2.98	.378	WG	146.490	.254	16.704***	(3)>(1)
	(3)senior	3.10	.371					
F3	(1)freshmen	3.02	.425	BG	.543	.271	1.727	--
	(2)2+3	2.98	.378	WG	90.671	.157		

	(3)senior	3.10	.371					
F4	(1)freshmen	2.72	.427	BG	1.311	.656		--
	(2)2+3	2.62	.486	WG	130.229	.226	2.905	
	(3)senior	2.62	.528					
F5	(1)freshmen	2.71	.406	BG	4.099	2.050	11.535***	(2)>(1)
	(2)2+3	2.88	.417	WG	102.530	.178		(3)>(1)
	(3)senior	2.88	.450					

$^*p<.05$; $^{**}p<.01$; $^{***}p<.001$

Table 3 and 4 investigates the differential results of students' levels of class and majors. To have a balanced sample size for performing comparisons, sophomore and junior are put into the same category as (2); literature, foreign languages, education and international affairs are put into the same category as (1) others. Table 3 shows that senior students exhibit strong positive performance than freshmen in the dimensions of transdisciplinary system (F=16.704, p<.001) and openness to alternatives (F=11.535, p<.001). Seniors are also more likely to be change agent that sophomores and juniors (F=3.889, p<.05). The results could be interpreted as influences of age and maturity of senior students. Table 4 indicates students of Business and Management College show relatively lower performance than students of Engineering and other Colleges in the dimension of transdisciplinary system (F=5.183, p<.01) and openness to alternatives (F=3.889, p,.05). The results may suggest that a new model of pedagogy, for business students, that are far more students centered and flexible, transforming the factory into the playground where learning becomes fun (Inayatullah, 2018).

Table 4: One-way ANOVA analysis of futures thinking by college

Factors	Class	Mean	SD	Sources of Variance	SS	MS	F	Sheffé post hoc multiple comparisons
F1	(1)Others	3.09	.399	BG	.753	.376		--
	(2)Engineer	3.05	.346	WG	90.976	.157	2.391	
	(3)Business	3.00	.411					
F2	(1)Others	3.13	.461	BG	2.756	1.378		(1)>(3)
	(2)Engineer	3.15	.547	WG	153.665	.266	5.183**	(2)>(3)
	(3)Business	3.00	.525					
F3	(1)Other	3.09	.395	BG	.040	.020		--
	(2)Engineer	3.11	.393	WG	91.672	.159	.126	
	(3)Business	3.11	.401					
F4	(1)Other	2.62	.502	BG	.311	.156		--
	(2)Engineer	2.67	.509	WG	132.217	.229	.681	
	(3)Business	2.67	.458					
F5	(1)Other	2.87	.445	BG	1.413	.707	3.889*	(1)>(3)
	(2)Engineer	2.86	.442	WG	105.030	.182		(2)>(3)
	(3)Business	2.77	.413					

$^*p<.05$; $^{**}p<.01$

The second part of the survey investigated a contrast - supposed vs. preferred - of the students' images of the future in terms of happiness, work, family, leisure, wealth, income and crime. The major interest was to discover if we could conceive of supposed futures and preferred futures from this contrast between students who have/haven't taken at least one futures course. The results in Table 5 indicate that students who have taken futures course demonstrate significantly optimistic attitudes toward happier life (p<.001), less material-oriented (p<.05), less unemployment (p<.01), and less crime (p<.01) in the year 2030. When asked about their preferred futures in a transformational fashion, the result evidently shows students have taken futures course preferred to have more female leaders (p<.05) in the future. Generally, futures-oriented pedagogy seem have prevailed preferred stories of

the future that are concerned with an open and post-material global environment, broad and diversified attitudes toward balance life and work, and most importantly, a multicultural and sharing world.

Table 5: Pearson Chi-square analysis of Supposed vs. preferred futures 2030

Items	Responses	Futures taken		Pearson Chi-square	Sig.
		Yes	No		
Supposed Futures 2030					
Be happier	Yes	72/54.5%	60/45.5%	10.834	.004
	No	158/56.6%	121/43.3%		
	Same	116/70.7%	48/29.3%		
Enjoy work	Yes	68/59.1%	47/40.9%	3.420	.181
	No	193/57.8%	141/42.2%		
	Same	84/67.2%	41/32.8%		
Less material	Yes	269/62.4%	162/37.6%	5.790	.055
	No	39/48.1%	42/51.9%		
	Same	38/60.3%	25/39.7%		
Stroger family ties	Yes	45/57.7%	33/42.3%	.246	.884
	No	246/60.4%	161/39.6%		
	Same	55/61.1%	35/38.9		
More leisure time	Yes	99/57.6%	73/42.4%	.981	.612
	No	196/60.9%	126/39.1%		
	Same	51/63.7%	29/36.3%		
Less unemployment	Yes	222/57.7%	163/42.3%	10.955	.004
	No	45/54.2%	38/45.8%		
	Same	80/74.1%	28/25.9		
Narrower income gap	Yes	292/60.8%	188/39.2%	4.149	.126
	No	23/47.9%	25/52.1%		
	Same	33/67.3%	16/32.7%		
Less crime	Yes	163/56.6%	125/43.4%	9.734	.008
	No	61/55.0%	50/45.0%		
	Same	123/69.9%	53/30.1%		
Preferred Futures 2030					
More open-minded youth	Yes	307/61.6%	191/38.4%	3.296	.912
	No	17/48.6%	18/51.4%		
	Same	24/53.3%	21/46.7%		
More young leader	Yes	290/62.4%	175/37.6	4.724	.094
	No	31/50.0%	31/50.0%		
	Same	27/52.9%	24/47.1%		
Stronger family ties	Yes	234/62.2%	142/37.8%	2.939	.230
	No	75/54.0%	64/46.0%		
	Same	38/61.3%	24/38.7%		
More female leaders	Yes	312/61.7%	194/38.3%	7.693	.021
	No	8/33.3%	16/66.7%		
	Same	28/59.6%	19/40.4%		

Live and work abroad	Yes	299/60.0%	199/40.0%	.073	.964
	No	18/60.0%	12/40.0%		
	Same	31/62.0%	19/38.0%		
Closer ties with China	Yes	184/58.8%	129/41.2%	.972	.615
	No	78/63.9%	44/36.1%		
	Same	86/60.1%	57/39.9%		

The third part of the survey concerns students' attitudes toward the emerging futures from STEEP perspective. Table 6 shows that students who have taken futures courses demonstrated systemically more positive orientations toward the year 2030 from all 15 questions. The term futures-orientation is defined as the degree to which one appears able to hold mental representations and evaluations of possible futures in such a way that this imagery may influence the selection of current action (McBride, Daniels, & Hines, 2019). One question has shown a statistically significant difference; students with higher futures-orientation were less likely to see the future where China will replace US and become the world's superpower ($p<.05$).

Table 6: Pearson Chi-square analysis of STEEP futures 2030

		Futures taken		Pearson	
Items	Responses	Yes	No	Chi-square	Sig.
Technology					
Tech decides children's personality	Yes	71/53.8%	61/46.2%	2.979	.053
	No	276/62.2%	168/37.8%		
Tech cures cancer and AIDS	Yes	329/61.0%	210/39.0	1.807	.179
	No	19/50.0%	19/50.0%		
Tech to reach to other planets	Yes	281/61.0%	180/39.0%	.488	.485
	No	66/57.4%	49/42.6%		
Society					
Aging is a tough problem	Yes	277/60.3%	182/39.7%	.005	.946
	No	69/60.0%	46/40.0%		
Agree with same-sex marriage	Yes	306/61.0%	196/39.0%	.670	.413
	No	42/56.0%	33/44.0%		
Increase tax for social welfare	Yes	148/60.9%	95/39.1%	.062	.804
	No	200/59.9%	134/40.1%		
Environment					
More trees than business building	Yes	289/60.2%	191/39.8%	.024	.878
	No	58/61.1%	37/38.9%		
Global warming affects life	Yes	314/60.4%	206/39.6%	.012	.914
	No	34/59.6%	23/40.4%		
Alternative energy	Yes	319/60.0%	213/40.0%	.348	.555
	No	29/64.4%	16/35.6%		
Economy					
Less work, more leisure	Yes	167/58.8%	117/41.2%	.588	.443
	No	179/61.9%	110/38.1%		
Higher income	Yes	189/59.8%	127/40.2%	.039	.844
	No	157/60.6%	102/39.4%		

Own a house	Yes	196/57.5%	145/42.5%	2.668	.102
	No	151/64.3%	84/35.7%		
Politics					
Terrorism still a global issue	Yes	221/59.6%	150/40.4%	.198	.656
	No	126/61.5%	79/38.5%		
Worsen political ecology	Yes	221/58.9%	154/41.1%	.770	.380
	No	126/62.7%	75/37.3%		
China replaces power of the US	Yes	148/55.4%	119/44.6%	5.603	.018
	No	198/65.1%	106/34.9%		

The final question of the third part of the survey concerns students' images of the future. This was given as multiple choice answers to the question "To me, the futures is like…," using their images of the futures to link with deeper metaphors. Those images were derived from a previous research done with Taiwanese high school students (Chen, 2016). The metaphor, "big boat in the ocean" denotes the aspirational future -You cannot always control the water so use your opportunity to row when you can. The worse-case future seem to be "Comet collide the earth" denotes a 'global killer' could collide with Earth very soon, wiping out life as we know it and changing the climate for millennia. The result indicates that students have drawn to similar metaphors, with highest percentage (21.6/19.1) for ocean and lowest percentage (3.7/6.2) for the doomsday scenario. Also responded at the lower preferences were for the metaphors "roller coaster" and "peeling an onion," meaning that control over life is something the students all desired. Somewhere in the middle are the metaphors of a Sci-Fi movie, a game of dice and a light at the end of the tunnel; metaphors for imagination, chance and change, respectively.

Table 7: Students' metaphors of the future

	Futures course taken			No futures course		
Future is like…	N	%	Rank	N	%	Rank
Roller coaster	81	11.7	5	70	16.1	5
Sci-Fi movie	122	17.6	4	80	18.4	2
Game of dice	127	18.3	3	71	16.4	4
Big boat in ocean	150	21.6	1	83	19.1	1
Peeling an onion	52	7.5	6	30	6.9	6
Light at the end of the tunnel	137	19.7	2	73	16.8	3
Comet collide the earth	26	3.7	7	27	6.2	7

Conclusion

This research is an initial exploratory investigation in evaluating the learning outcomes of Tamkang University's students and impact of futures-oriented pedagogy. After surveying a sample of 578 students, the study has successfully analyzed five dimensions of futures-oriented thinking: change agent, transdisciplinary system, long-term thinking, concern for others and openness to alternatives. The results indicate that students who have taken futures courses demonstrated higher performance in two dimensions of futures thinking, namely transdisciplinary system and openness to alternatives. Additionally, they are more optimistic toward the year 2030. While male students exhibited significant higher level of change-agent futures thinking than that of female students, freshman, students of Business College and less active in club activities exhibited lower performance in three dimensions of futures thinking. A result also worth noting is that the dimension of long-term thinking systemically did not contribute any significant influence to the process of futures learning. Further research needs to pay special attention to this phenomenon. The emerging empirical approach of evaluating futures learning outcomes can be comparable and adopted by a larger of similar educational organizations. Gradually, we in the futures community can all benefited from the accumulative fruits of research paving solid paths for futures-oriented pedagogical design.

The legacy of Tamkang University's futures-oriented education is crucial but is being impacted by emerging challenges -First, via market pressures where the deeper notions of service are challenged by corporatist pressures, financial concerns. The traditional high socio-cultural valuing of education has to face the increasing competition over resources. Second, ways of learning is challenged by the technological revolution in the educational arena - the flipped classroom, distance as well as flexible learning. For professors to thrive in the new forms of learning organizations, flexibility of roles are crucial - as problem solver, gamer, designer, facilitator, and the like. Changing the mindset from "what's in it for me?" to "we are in this together" (Inayatullah, 2018). Third, futures-oriented thinking is becoming more important. The broader context is to apply foresight practice as well as results of futures empirical research, so that futures practitioners can widely use the knowledge and strategic framework to enhance the ability of all sectors of the society to think forward and far ahead of current problems.

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