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Edu-Tensegrity: An Expanded Integration of 21st Century Education

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Abstract

The central concept within this research work is Edu-tensegrity. It is the foundation of the Heasly Thinking Skills System and uses a geodesic dome as a refreshed visual depiction of the many varied elements in the whole world of education, given paradigm changes within lived experience of 21st century education. This system uses a disciplined use of the art of Questioning, a 'ME' diagram, a fully explained process of decision-making, and finally a detailed diagram called the HUG/BUG for application of personally chosen behaviours. This paper explains the integrated connections of education concepts with similar knowledge content from other relevant academic disciplines. The aim allows for the academic support of teachers and lecturers as these paradigm changes are affected, relying on resilience and the authentic projects of our research communities, who are central to the concept of Edu-tensegrity. Edu-tensegrity is central to the twin concepts of Sustainability and Securitability, adding to the educational philosophy of this journal, and cementing the changing landscape of 21st century education in a time of pandemic and change.

Key words: edu-tensegrity, application of the HUG/BUG, sustainability, securitability, democracy, research communities

Introduction

The author presents her concept of Edu-tensegrity and emphasise the use of teaching thinking skills in classroom settings, highlighting the trilectic thinking processes (based on the careful measuring of many options) central to teaching democratic nuanced thinking skills. Each diagram follows as an integrated process and highlights the integration of three interlocking concepts – becoming the foundations for theory, practice and praxis. One of the relevant emphases addresses the blurring of rigid boundaries of particular disciplines, of diversity of cultures, of the politics of disruption: all of these considerations lead to a deeper understanding of the enterprise of Education in 21st century lived experience, including covid pandemic conditions. The various outcomes also lead to an expanded understanding of the universe and the place of the human person and human communities within that universe. That place obliges us to provide responsibly shaped and designed education for the betterment of all humankind.

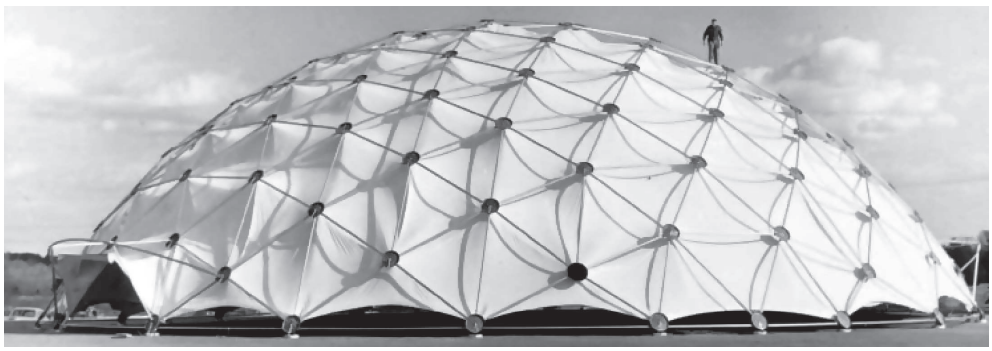
She highlights, therefore, how the steps of the Heasly Thinking Skills System promote the knowledge, the gathering of skills, and the development of decision-making expertise for teachers, students, educational specialists, in today's uncertain times. The need for Education, in all its integrated domains, to lead the way in addressing Change, Uncertainty, the experience of trashing of Trust, and incompetence in Governance at local and global levels, is patently obvious.

The four main tools which are offered as an integrated system within the Heasly Thinking Skills System rely on the well-constructed use of Questioning, the visualisation of the individual within the "ME" diagram, the recognition of the processes of the six steps of authentic decision-making, and the knowledge base of chosen behaviours forming the foundation of the attitude and perspective of individual ethical behaviours chosen by any individual to suit 21st century social and cultural conditions. The details of this whole concept make up the content of Edu-tensegrity and are explained in detail (Heasly, 2020).

In particular, the growing urgency, to find new ways to develop Sustainability and Securitability, shines out as governments are stretched to combat the twin pandemics of Covic-19 and embedded global Racism, while promoting urgent strategies to heal the degradation of our Planet Earth. These phenomena provide us with challenges that contradict our tendency to wish for a return to the familiarity of what we once knew as normal living conditions. These issues and concerns lead us to examine the geodesic dome as a metaphor for building an education system that meets the needs of today and tomorrow, rather than yesterday.

Figure 1

Picture of a Geodesic Dome



Source: *Scientific American*, January, 1998, p. 50.

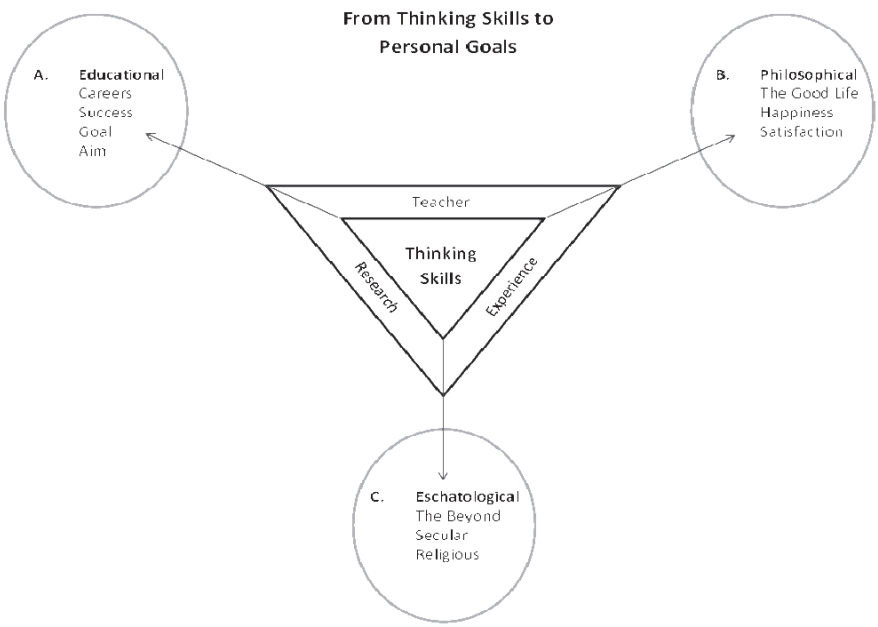
Donald Ingber tried to develop for science and eventually for education the architectural principles which originated in Engineering and allied professions and his research provided us with an expanding understanding of any of the large entities in our different cultures. The diagram shows a person standing high on the roof of the structure which was not square or oblong, but had multiple elements which seemed to still stay upright and balanced, even as so many sections contributed to the balanced whole of the structure. The architectural principles which are involved show that provided the push and pull of the various poles, pressure points and other important strengths are balanced, the whole will remain as a firm structure.

So, it is with the whole huge enterprise we call Education. If the sections we can see in the diagram represented different domains of the business of Education on a grand scale, plus the various smaller and more localised sections familiar to each of us, as students, teachers, researchers and parents, we can recognise that the push-and-pull factors must change, develop, expand or depress at certain points. So Change of Paradigm is flagged, as a natural part of this whole scenario of Education, and progressively, new cultural or geographic phenomena demand our response.

The aim and further expansion of this investigation has been to focus on the systematic development of a parallel architecture for teaching about the concepts and practical outcomes of such relevant Virtues, Values and Ethics for twenty-first century education as they are needed. The reason for this investigation is to address the need to aid in the democratic moves for students to proceed *from* thinking skills as skills and art *towards* the shaping of their own personal goals. In such a process, (see below), it is necessary to examine and analyse the business of thinking skills, reasoning, and decision-making. This necessity is further needed to shape individual and collaborative ethics and norms that allow a legitimate focus on the common good. This provides an avenue for individualised education that acknowledges the uniqueness of each person in the classroom, including the teacher, and allows the understanding of the diversity of knowledge and experience that we bring to the classroom for successful outcomes of learning, at a personal, local and community level.

Figure 2

Triangular Connections



Within this system, the author is applying the concepts of 'bricolage' because this concept has a precise impact overall within this proposed architecture, which will underpin my concept of Edu-tensegrity (see Ling, 2012). In today's digital age when

pressing a button can give access to information almost instantly, we need the *skills of bricolage*. To be a bricoleur is a major element in the profile of a researcher and of a functioning mature member of each cultural group, because it is now necessary to consciously bridge many perceived chasms within the concept of Edu-tensegrity. That geodesic dome tells us that researching relevant connections, which have been in existence in our familiar disciplines and subject domains, can provide unexpected and exciting discoveries to broaden the accuracy and authenticity of our own research area.

In connecting the Heasly Thinking Skills System to the needs of 21st century educational needs, I am building on research already in existence. The Educational value of the system connects to an individual philosophical set of theories which surround the very complicated concept of Democracy, but these two concepts connect also with Eschatological elements and consequently may not be ignored. Whether applying the System itself from a religious or a secular starting point, it is important to note that each growing individual gathers a mature outlook and responds to various phenomena by decisions that build into a personal philosophy, or a set of Values that resonate with the decision-maker's way of seeing the world. It is therefore possible to posit that the Heasly Thinking Skills System builds at least one channel from Thinking Skills to personal decisions to personal responsibility for each self today. The four integrated Steps in the Heasly Thinking Skills System need to be shaped into the concepts of Sustainability and Securitability for 21st century use (Heasly et al., 2021).

Significant to this focus is a deepened understanding of what the concept of democracy means (Dewey, 1944). We can find various definitions of what the concept means by remembering its origin in ancient Greek language. We recall carefully the two most familiar forms of democracy today: direct from the people in concert, or representative of the people by voting and consultation. Democracy is posited on the power of the people to manage successfully all the various phenomena which contribute to daily life in a given culture or nation. Application of balanced ethical norms, and consultative process by which problems, paradoxes and paradigm changes are addressed, means allowing for a myriad of nuanced opinions, ideologies and beliefs. We remember the distinctions between a consensus democracy (direct majority rule by the people), a constitutional democracy (governed by a national constitution) and a deliberative democracy (strictly applied deliberation, including voting, at relevant levels to provide legitimate decision-making for common problems and interests). There are however current difficulties in 21st century sustainability terms, outlined by Michael Peters recently (Peters, 2017).

In applying this large, nuanced concept in Education called Edu-tensegrity, we could use the geodesic dome to maintain the various focus points to accent freedoms of many kinds, and to acknowledge opposition. We are reasonably familiar with the existence today of social democracy, workplace democracy, deliberative democracy, industrial and corporate democracy, shareholder democracy and the possibility of advanced democracy – each allows us to define goals and ambitions for a better world or a better society in which all may contribute. Schumpeter (2009) also alerted us to the emphases on aggregation of preferences exhibited within and because of political parties. Schumpeter was a great economist of mid-20th century, known for theories on business cycles, capitalist development through his expansion of the concept of entrepreneurship. We of course are aware of the recognisable parallel in Johannes Lindner's approach to

sustainable education through entrepreneurship in the classroom, as the application applies to Edu-tensegrity (Heasly, 2019, pp. 152–54). Schumpeter analysed what he called 'creative destruction' in the world of industry, monitoring and tending to the economic structures as they arise, thrive, then break down, destroying practices no longer fit for purpose, and allowing the emergence of new structures and skills. In today's world we find echoes of his work, in evolutionary cycles all around us, as we strive to develop and incorporate new methodologies, new praxis and new theories for sustainability and securitability. This Schumpeter complexity situates well therefore in the concept of Edu-tensegrity.

To understand how Education contributes to this huge enterprise, we recognise the need for thinking skills, for balanced social understandings, for learning of the various relevant virtues (habits of behaviour), values (knowledge of important beliefs and behaviours) and ethics (thinking patterns and behaviour patterns designed to allow the emergence of outcomes for the common good).

At one end of the philosophy of education spectrum is the emerging forms and applications of chaos theory, which originated in mathematics. There are many social elements which are visible when inspecting and analysing the implications of chaos theory. Chaos theory is the study of apparently random or unpredictable behaviours in a system governed by more determined and visible laws. What, at first glance, is deemed to be a problem, a paradox, or apparent mystery because it identifies the extreme opposites beyond adversarial stances, is inhabited by two notions which seem impossible to be reconciled.

Very small, even infinitesimal, changes in circumstances or patterns of behaviours within one of those notions, can result in a trajectory of change. The consequence of such a change will influence outcomes, will impact the whole, and will highlight emergent predictable results. An accessible example is the prediction of weather patterns within a given trajectory or zone. A by-product of such system outcomes may result in unintended consequences if human influence provides the small change.

Some people have likened these phenomena to a kind of science of surprises, not always comfortable, but always unexpected. So, what is to count as accuracy and what is to be titled inaccuracy is a central issue. Robert Devaney, an early exponent of chaos theory, first talked about an identifiable state of disorder (Devaney, 2003). Edward Lorenz (1995), taking up these matters, talked of the effect of butterfly wings in one continent making an impact or change in another continent. The sensitivity issue of such a tiny change served to help non-mathematicians like me, to recognise how prediction of expected results in research must be handled accurately by those versed in such calculations. However, attention to the arc of response – response-ability – responsibility which is a feature of the Heasly Thinking Skills System is very relevant here.

Implications of this seem beyond the scope of this paper, but indications identify where subtle changes in curriculum content, suitably shaped for classroom consumption, can influence how we attain a pathway towards Sustainability and Securitability within the overall concept of Edu-tensegrity. The changes which will exist because of current research will function within the geodesic dome of education, and affect or effect unpredictable or dimly predictable, changes and balances within our applications of the concept of Edu-tensegrity. Of course, the onset of the global pandemic and the necessity for quarantine and universal online education, managed in different ways by nations worried

also by collapse of national economies becomes a new element within the development of curriculum content and is a ménage of unfinished business for 2021 and beyond.

Before proceeding, we need to identify the significant elements of both concepts, accepting that there will be overlaps as we deepen our understanding of the way these two concepts can address the needs and identify the aims of research projects which appear in our journal. Sustainability aims at long-term success whereas Securitability aims at quality of product (needing research); Sustainability needs carefully planned timelines whereas Securitability offers suitable content; Sustainability needs frequent checks and balances for authenticity whereas Securitability requires those checks and balances to be focussed on standards of excellence; Sustainability needs ethical auditing arrangements for long-term excellence whereas Securitability needs mentoring to increase levels of integrity of educational aims; Sustainability needs long-term focussed planning for quality of educational outcomes whereas Securitability needs professional self-critique and development for teachers as change agents (Salīte, 2015).

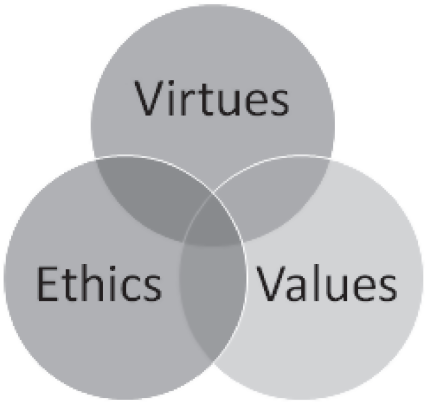
Chaos is all around us, contributing to evolutionary emergence of diversity, difference, ideological stances, disparate beliefs, existence of fake news, and mystical religious beliefs. It is important to identify where a person is seen as chaotic, the patterns of behaviour exhibited are upset, anger, truculence, having no ability to emerge from a state of disorder, with a set permanence of refusal to communicate, or to develop the skills of listening. Such psychological phenomena need careful and sensitive responses from teachers and educational practitioners alike, for the maximising of knowledge accessible to students.

It is important for clarity in research then, to understand that chaos theory highlights apparent randomness and disorder in systems, even government and education systems, and that is immediately visible. However, underlying patterns not always discernible, can provide relief in a resulting interconnectedness, leading to the last two steps of the Heasly Decision-making Process. Mistakes are not failure and new efforts to solve or manage problems, paradoxes or paradigm changes emerge as feedback from new understandings of the mistakes – providing more accuracy, knowledge and expertise. This measurement aligns with the dependent – independent – interdependent arc which is a feature of the Heasly Thinking Skills System. Teaching our students, the rudiments of how chaos theory is present in our cultures, our lives, our futures is central to 21st century education. It is central to our understanding of the widening and enveloping concept of Edu-tensegrity (Davies & Harre, 1990). Davies gives careful and detailed understanding of key concepts of chaos theory, uncovering the phenomena of structures that seem at first sight to be invisible or non-existent.

Response-ability then hinges on the analysis of what is to count as the relevant virtues (personal habits of behaviour), values (commonly held cultural patterns of behaviour) and ethics (cultural or national standards of what is to count as expected patterns of behaviour judged as relevant to the common good). Evolution within the lifetimes and lifestyles of nations globally will produce some commonality but also much diversity in the choices emerging inductively in tribal, national, and altruistic communities worldwide: hence the significance of chaos theory and its proposed application by experts. A number of considerations for Virtues, Values, Ethics emerge.

Figure 3

Interconnectedness of Virtues, Values, and Ethics



The focus of the early research was to find ways to address meaning with clarity and effectiveness for students at primary, secondary and tertiary levels of education without cancelling out the foundations of national diversity, individual cultures, quality of life, and belief systems within diverse backgrounds. I present upgraded definitions of the concepts of Virtues, Values and Ethics, which are in tune with global conditions in twenty-first century education. It becomes obvious that in today's uncertain times, the complications and implications of what we find in the world around us, will colour the values we apply to the various stages of decision-making. It also implies that each person's decision will be a personal responsibility, influencing habits of behaviour (sometimes called virtues), building value sets, and resonating in the ethical behaviours we exhibit in daily life.

The whole system still applies, when we are faced with pandemic conditions, with overwhelming evidence of brutal, colonial racism, with serious degradation and growing waste within a groaning planet needing our immediate and urgent attention, and with the crucial need for recognition of what we will lose, if democracy is smashed. The emerging understanding of what the various principles of Democracy need to be in 21st century cultures shows us that personal integrity leads to Trust; that personal decisions leads to Authenticity; that personal collaboration at all levels as we grow leads to Maturity; that each person needs the vital connections existing within home cultures; that home cultures need to register and model harmony measuring the common good.

This emerging evidence all over the world at the beginning of this decade challenges us to regroup, to review, to recognise change in its many phases and voices. There will be a tendency to wish to return to what we might once have called 'normal' life, but multiple harsh weather patterns emerging everywhere, described by the experts, push us to accept that change also means change of paradigm. Another emerging set of phenomena is the increasing appearance today of demagogues, oligarchs and dictators. All these elements of evidence alert us to the possibility of impending calamity on a world-wide scale. We need therefore to find the many skills, expertise, knowledge coupled with relevant virtues, values and ethical behaviours which will promote outcomes of well-being, of sustainability and of securitability. This implies the need for cautious but urgent change of paradigm, with aims that avoid that calamitous future lurking around us. Uncertainty of how to address such a huge agenda starts with using thinking skills,

with collaboration within the educational scenario, with planning for community well-being and with a common regard for the sustainable future of our world today.

Change of paradigm means listening, attending, understanding, testing, collaborating, critiquing our own experiences with clarity and patience as this decade progresses, finding ways to agree on short-term, longer-term and lasting goals for the urgent upgrade in quality of life in every nation. Change of paradigm means listening to people with clashing views and committing to finding ways to understand each other, without distrust, disrespect, adversarialist behaviours and without provocative responses.

Adversarialism, greed, corruption, deception and brutality must be addressed, and the Heasly Thinking Skills System is one opportunity to include within our education scenario sufficient chances to recognise the search for appropriate attitudes, ways of behaving, readiness for research, generosity and sharing – all of which push us to work for a future which is not doomed. We can't go back to 'normal', when that 'normal' includes war, slavery, trafficking in humans, nuclear weapons, continuous degradation of our planet, species extinction, ocean pollution, brutal racism, specious colonialism, greed and corruption in leadership, instant and constant personal gratification, child sexual abuse, and the ultimate betrayal of ordinary people by those vested with power in leadership to set in motion what is needed to heal our world and all its inhabitants! (Heasly, 2019).

Figure 4

Virtues, Values and Ethics



Voices in the initial research program refer to my PhD thesis and they include three sources: 1. the voices of teachers at the coalface in three countries – Australia, New Zealand and England; 2. voices of educationalists: educational philosophers, educational psychologists, and educational sociologists over a long gestation period within my school teaching career; and thirdly an extensive auto-ethnographic retrospective in which I used my voice and shaped an Inductive Data Reduction chart founded on the learning and experience of my 36 years in secondary teaching.

Research already in existence shows us, that the indications of what could be changed by political decision-making, is already available. Some decisions are quite striking, and demand our understanding, acceptance and immediate action. Consequently, it is important that we recognise that doing research is insufficient if it is not undertaken to provide sustainability and securitability, and this means we must resist the tendency to

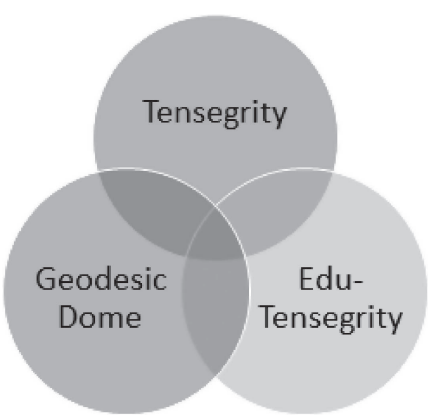
go back to what we knew was successful in times past, because the universal changes in our world in 21st conditions, both positive and negative, are changes that show those earlier patterns are no longer fit for purpose (Heasly et al., 2020). It will need careful and insightful decision-making to make education authentically fit for purpose as we stride into the middle of the 21st century.

So much evidence suggests we are on the cusp of an engulfing series of changes, and we need to keep responding and planning so that we are not overwhelmed. Reluctance to take up the responsibilities inherent in this area will result in doom and gloom and failed nation states, and the chaos that accompanies the politics of disruption. Inevitably, it becomes obvious that research projects are needed on a continuous basis, but so is collating relevant research from many sources by those who are tasked with deciding which pilot schemes will successfully test and improve the outcomes we need to address, in the many needs of 21st century populations on a global scale. One outstanding example of this emphasis on research is our journal series of UNESCO 'on the interplay of Tradition and Innovation in Education for Sustainable Development' of at least fifteen years duration titled: 'Discourse and Communication for Sustainable Education'.

Voices within the bulging, heaving entity we call Education, and to which my concept of Edu-tensegrity applies, are needed in a cohesive, collaborative development of research urgently. So much is already in train, and the Heasly Thinking Skills System contributes to the inherent value required to address the needs of the Generation Z students at primary, secondary and tertiary levels. Despite challenging world circumstances, we can't desert our newer generations. The uncertainty of prevailing world conditions demand that we include at all levels, the various needs of the coming generations. Pandemic conditions already have many Voices predicting that the depth of education for the students at each level is seriously compromised. Pre-service and Continuing teachers have much educational wisdom to offer; educational practitioners have a deeply important role with significant wisdom capable of providing authentic and urgent theory and knowledge to facilitate change; the teams of researchers, whose role and function is to test, to authenticate, and to recommend how change can be inserted into present theory, practice and praxis must be present: all are vital in the redemption, rejuvenation and reformation of what is to count as global and local education for this decade (Heasly, 2020).

Figure 5

Edu-Tensegrity



Following Donald Ingber and further to explanations shown above, I have examined the concept of tensegrity. The concept itself incorporates the tension and release of strength in building for architectural purposes, but the principles of this concept are present in the cosmos and in nature. To apply the principles of tensegrity to the world of Biology, as Ingber did, we begin to perceive how the metaphor itself can teach us a broader concept of how so many of the creatures that inhabit our planet are connected, in an evolutionary manner, and that includes our battered and beleaguered present generations of humankind. So emerged the term: Bio-tensegrity. So, as in Ingber's framework of bio-tensegrity, my perceived next step in application of the architectural principles, highlights how all growth follows this complex system.

After much deliberation, I applied the same set of principles to education. To follow the parallel of bio-tensegrity, I applied the details of tensegrity to the whole scenario of Education. By degrees, we can see that the principles of tensegrity can provide us with a refreshed picture of the business of what is to count as education for present generations. Emphases change, as we watch the historical development of education over the last century and a half, as ways of teaching, ways of learning, expansion of educational skills, expansion of thinking skills, management of knowledge retention, development of collaborative education, holistic education, secular education, religious education, political education: all these elements within the picture of edu-tensegrity begin to merge towards each other and provide us with new emphases. The consequences can be very broad, but different pulses of central importance for teachers, theorists, researchers and students can be pictured in the geodesic dome. Education is no longer therefore the retention of static information, and strict rules for students. All sorts of old educational boundaries begin to fade, so the need to decide what centrally is needed for our present generations, leads us towards a change of educational paradigm. This is in evidence when we look at the various ways in which educational requirements have changed since the Millennium goals in Europe were set. Change has been also forced on a global scale by the requirements of fighting the overwhelmingly serious consequences of the covid-19 coronavirus pandemic.

Ingber indicated the geodesic dome as the best visual presentation of how this scientific concept works. I used that same geodesic dome as a foundation of all the diverse elements which belong to the concept of education. So, Edu-tensegrity emerged as a foundation for me for twenty-first century global education, because it allowed for universal and diverse elements to be included.

The entry of pandemic conditions in 2020 has begun to show us what happens if the bands of tensegrity – Edu-tensegrity are broken. Research in monitoring how national planning and progress develops, will be needed urgently, to find ways of shaping and supporting the experience of education for the present generations. Action will be needed immediately to support primary, secondary and tertiary students to negotiate the changing nature of the world around them. Much of this research is already in train, but Change will become very familiar, and individuals will need the knowledge inherent in the first steps of the Heasly Thinking Skills System to support them through their education.

The *first step* is fearless use of systematic questioning when facing hurdles or difficulties as they progress, because systematic questioning leads to a questing attitude and promotes broad and fearless research; the *second step* is the careful use of the 'ME' diagram, because application of this diagram to our daily personal situation points us towards understanding each self as unique and allows us to visualise and deepen our understanding of our place in our own family, in our own culture and in our personal

and collective futures. Both of these steps give each individual the tools and skills to make insightful decisions for the future. The *third step* gives students and teachers, in individual subject domains, and in general wellbeing for students, a six-step process by which serious decisions can be made. It is at this stage that the need to choose which relevant virtues, which personal or communal values, which ethical standards of justice, honesty and respect will be suitable in the new developing home cultures.

But it is the future of the planet we call home that is also in the balance as well as our new generations. So, the fulfilment of the development of ethics and ethical behaviour emerges as their personal and generational decisions affect themselves, their personal environment and their consequential influence of the world around them. It becomes significant that a balance must be achieved between personal comfort and prudential moves for the betterment of particular situations and community needs.

This is particularly obvious in the arc of response; response-ability; responsibility. To *respond* to different problems, paradoxes, calamities, pandemics and disasters, it becomes obvious that we need *response-ability* (i.e., the knowledge, insight, and ability to respond adequately and not short-sightedly). This means research, planning, governmental collaboration, and educational goals like the Millennium goals of UNESCO, and then decisions about what and how actions will be carried out. Finally, *responsibility* for action, monitoring of new consequential development, and the courage to admit where mistakes have occurred, must be remedied urgently. Adversarialism is not appropriate as, too often it becomes a means of undermining the work and the responsibility we have to the coming generations.

Edu-tensegrity has a central part to play, allowing us to tailor particular educational initiatives to be used, without resorting to short-term binary thinking, and without trying unending pilot programs which have not discernible educational futures. Binary thinking seems to have been the universal pattern of thinking skills to the exclusion of trilectic and quadrilectic patterns of thinking since the advent of the industrial revolution and before. It is now time to learn how to choose when binary thinking patterns are no longer relevant. Chaos theory shows us that trilectic and quadrilectic thinking skills are paramount when applying decisions in sensitive and significant situations in 21st century cultural milieux, and Edu-tensegrity demands that we model what we are teaching to current and new generations. Adversarialism adds to chaos and undermines the possible practice of finding, managing or solving problems, paradoxes and paradigm changes.

It is important to recognise that the Heasly Thinking Skills System, which was the outcome of the initial research program, is seen as a way of ensuring self-supporting skills in thinking, in questioning, in researching, in collaborating, and in planning how to proceed for a fractured social system in individual countries. People everywhere will need the personal skills to accept and hone their abilities to be resilient, self-supporting, independent, but also interdependent, as we negotiate the next steps in our journey into mid-century global interactions. To do this is urgent, as we integrate the significant development of climate change, eradicate the conditions that allow for human trafficking, and address with precision the need to wipe out the brutality of racism in all its forms.

The use of trilectic thinking, i.e., the deliberate inclusion of as many options as we can muster, when we plan, is central to progress. Binary thinking (either/or) has often been disastrous when applied to universal decision-making, often promoting adversarialism as a central or even exclusive focus. We must therefore provide systems and conditions where it is possible to teach as part of education, the vital importance of 'both/ and' but

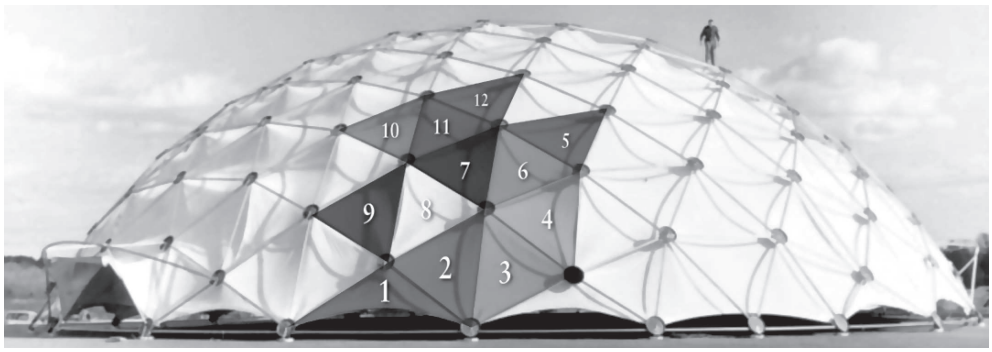
also 'both/and … and' – a method of extended (trilectic and even quadrilectic) thinking processes which depends on careful and logical exploration of all options as we decide how to proceed in this new set of conditions in our groaning planetary home.

The geodesic dome, which enlarges our understanding of the world around us, and introduces us to inclusive thinking patterns, is central to this overall concept of Edu-tensegrity. It is inherently a self-supporting concept of behaviour and living experience. This lived experience is influenced by a series of elements within our cultural expressions and these need to be outlined, understood and implemented. I have discovered a list of these relevant influences. To avoid the older style of binary thinking (either/or) which leads too often to exclusion, mistakes and failures, I have highlighted the thinking patterns which rely on what I have called trilectic thinking (both/ and), allowing the expanded thinking that is needed to incorporate so many newer elements of today, like the digital world of mobiles, facebook and even google as a research tool. Of course, an extension of trilectic thinking into quadrilectic thinking means that we rely on 'both/and … and' to expand our horizons as we focus on problems, paradoxes, and paradigm changes.

Students need to be equipped to negotiate the pathways that are necessary to be successful in this new world, where cosmic exploration, robotic tools and artificial intelligence are revolutionising much of what was familiar even ten years ago. The need to learn how to understand fake news phenomena and the manipulation of global trends is one urgent reason why change of paradigm is so necessary, and why teaching a systematic approach to thinking skills is central to such a serious aim. Education today holds a key to accessing the tools for such a serious aim and allows facilitation of harmonious collaboration within those many categories of influence.

Figure 6

Geodesic Dome



Source: *Scientific American*, January, 1998, p. 48; digitally altered by Scott Larritt-Evans.

Having constructed the geodesic dome as a concept of education (Heasly, 2015), I believe, these Categories of Influence, which are central to what counts as elements of education today, must be placed firmly in the centre of the dome, so that all manner of other elements we know will integrate around them: philosophy, psychology, curriculum, administration, pastoral initiatives, specialist areas for individual student needs, and other considerations (Heasly, 2015). The whole education concept then depends for global purposes on the balance between the push and full factors that emerge regularly

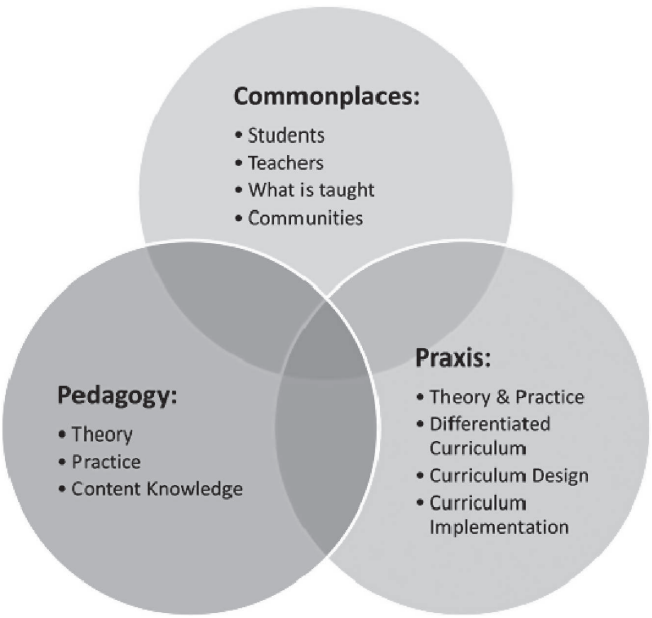
in primary, secondary and tertiary classrooms. Those push-and-pull factors are being dismantled by the conditions forced on all nations as we face the chaos of the covid-19 pandemic.

The importance of cultural changes over the last century leads me to acknowledge that educational practices of yesteryear are not quite accurate for students needs in the twenty-first century. Within the working paradigm of twentieth century education, philosophy of education, plus psychology of education and sociology of education lost precedence for teachers and politicians, – as war, population explosion, technology, international travel and more brought clashes of cultures, lifestyles, religions and philosophies. In twenty-first century education, we need a fresh shape of all these disciplines, relevant to change needed for students to learn, to thrive, to flourish. So was born the concept of Edu-tensegrity based firmly on the geodesic dome.

We are now faced with the questions of Sustainability and Securitability on our groaning planet. Developments under UNESCO Millennium goals have already shown that the central question of Sustainability is significant. It is important to allow ourselves to recognise the inherent value of philosophical enterprise, psychological principles for well-being, and sociological structures which are changing or disintegrating in plain view. Sustainability has emerged as a central concept which acts as a strong balance to the instant requirement promoted by advertising, drive-by, eating-out, and other parallel phenomena designed to make us accept a dependent lifestyle. Securitability also allows us to recognise that the throw-away culture and waste which accompanies that 'instant gratification' lifestyle, can be balanced and preferred so that much that we value can be extended, secured, valued and given long life, thereby contributing to well-being and settled understanding in our changing world.

Figure 7

Curriculum Application



If we review the role and function of curriculum content, the interaction between students and teachers, and familiarise ourselves with what is taught and with the precise place within each community of such content, education takes place. We distinguish between thinking inductively and deductively, as merging inductively from renewed emphases, methodologies relevant to knowledge content can provide exciting and accurate shared learning. We recognise that universal elements are *common* to all educational enterprises: students, teachers or lecturers (including facilitators and specialists), the content of a given planned curriculum and a sustaining community of which parents are a leading element. We appreciate the pedagogical bank of information, insights, theory, practice and common knowledge, with which each teacher must be armed, to develop the skills of teaching. We are alert to the needs of researchers who contribute accurately to finding solutions, whether short or long term.

Praxis is the overall revision and expert decision-making of such theory and practice to provide differentiated curriculum relevant to student needs rather than elegance of planning of content alone. This is the natural home for the various research projects which need our attention as change of paradigm emerges regularly, and adjustments must be addressed in harmonious discourse rather than adversarial stances relying on binary thinking patterns.

Curriculum design is central, but equally curriculum implementation needs to be accurate, tailored vocationally to student knowledge, skills – already present: in diverse ways, culturally, incrementally, as the student's experience of education progresses. To address the diversity of needs of the students in any class, we need differentiation of skills, classroom practices and curriculum design. This implies authentic delivery of the content of curriculum as planned, especially the completion of all elements of the curriculum plan according to Learning Outcomes, and at the appropriate level of complexity.

Figure 8

Curriculum Research



Increasingly, supportive Curriculum Research needs to be embedded in qualitative research methods and methodologies. Without dismissing the significance of quantitative research, twenty-first century global education requires that we listen to and promote inductive thinking approaches. The necessity of being dependent on mathematicians and other experts for quantitative research is increasingly central to current research, if we are to make allowance for the calculations of chaos theory, and the consequential relevance of evolutionary changes being discovered today. The continuous work of research is promoted in our Journal publishing research papers under the auspices of the UNESCO Chair on the interplay of Tradition and Innovation in Education for Sustainable Development. It is rightly claimed for the journal series *"Discourse and Communication for Sustainable Education"* as a model of evolutionary education and research from the Department of Education in Daugavpils University, Latvia, ably supported by Education Faculties all over Europe and beyond.

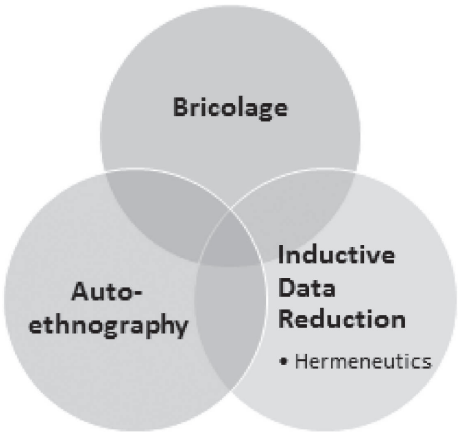
Ontological accuracy in a fast-changing world harnesses the emerging information about the nature of things, the big ideas, forming the foundations of the teaching-learning processes used. Increased numbers of research projects help us to recognise the true nature of the world around us, and this is aided by sophisticated digital conglomerations allowing for the microscopic treatment of viruses and the immediacy of impact of sudden, brutal and violent physical phenomena that disrupts the existing patterns of life and culture. Add to this experience, the apparent politics of disruption abroad as further evolutionary influences emerge, and we conclude that Edu-tensegrity and our understandings of what counts as education today is a vital and changing concept.

Epistemological shaping of new or improved approaches to the theory of knowledge must allow for teaching styles, learning styles, and broad spectrums of new knowledge content, including how the brain learns. This serves student needs accurately, efficiently, effectively in diverse circumstances (Heasly, 2015, pp. 6–14). Converting the various research questions into manageable projects and preparing each project for action allows teachers and educational practitioners to hone their inductive thinking skills as they introduce newer curriculum content or refreshed classroom practices for more authentic and accurate knowledge for student retention and subsequent resilience.

It becomes apparent that the business of bricolage now assumes a central role and function in the schema that live within the concept of Edu-tensegrity. The three integrated elements of bricolage, auto-ethnography and inductive data reduction now provide teachers and practitioners with further tools to uncover accurate and authentic passing on of knowledge, skills and know-how to students at all levels of primary, secondary and tertiary education.

Figure 9

Processes of Ethnography



Within the recognised processes of qualitative research, ethnography – or the study of people, problems, and places – can provide rich pickings for the researcher: *'bricolage'* (Ling, 2012) is the gathering of data from wide spectrums of daily experience. Today's familiarity with the proximity of the digital dictionary, and the enormous bulk of information must not be allowed to drown the student or the teacher with mounds of information, at the expense of knowledge, so research methodologies become a central tool for teaching and modelling for students how we test, analyse, manage or solve intricate questions and promote such active processes to students. Trilectic thinking patterns allow us to ask as many questions as possible, and to dismiss no question unless there is no available knowledge to answer what the question is pinpointing for the solving process.

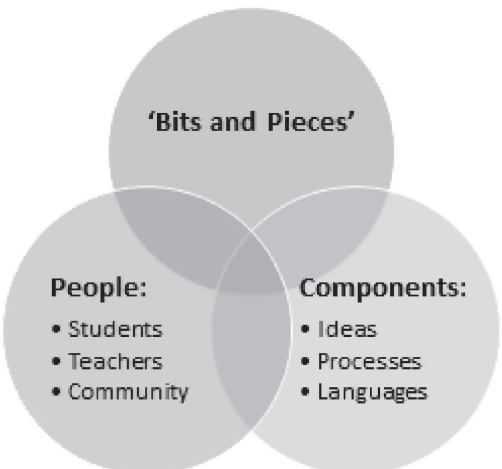
Auto-ethnography (Beattie, 2009; Roth & Roth, 2005) allows for accurate critiques of personal, unique and diverse educational experience. Paradigm Change is now familiar enough for teachers, both pre-service and continuing teachers, to allow a fearless critique of personal progress in the business of what constitutes the teaching-learning process. What was sufficient as classroom practice and promotion of student self-sufficiency ten years ago will be subject to subtle change, much like the butterfly effect that Lorenz introduced. Exciting outcomes as students find new information, unexpected evidence and authentic responses to the myriad of questions that precede research, make the future of education and its inevitable evolutionary aspects a promising and fulfilling prospect for teachers.

Inductive Data Reduction schema compels detailed conclusions that respect the myriad elements emerging inductively from individuals, and their relevant experience. This allows new valuable conclusions which inform further the accuracy needed to promote effective education. The continuous effect of ongoing research done concurrently today means that there will be evidence that more understanding of conceptual frameworks can be available for students. It becomes apparent that binary thinking has a particular and precise part to play, but it must not take the place of trilectic or quadrilectic thinking patterns otherwise the butterfly effect is buried, invisible and lost. Complexity

is a tool that is needed to avoid simplistic control by those in powerful positions as a means of managing social control of whole communities. So a simple rule of thumb is possible for the introduction into primary classes that if there is only one answer to a conundrum, it is too simple and needs to be revisited. This is what happens when available data is inspected, analysed, tested, and critiqued to reduce the possibility of non-logical outcomes. Boundaries that were accepted in twentieth century learning are blurred, as the 'bits and pieces' of connections to our questions, as we take up the tools of bricolage, as the emerging content changes the colours of information into knowledge, so subtly that we find new conclusions to existing questions.

Figure 10

Ethnography – Bricolage: "Bits and Pieces," People, Components



To promote the idea of '*bricolage*', I can detail and include all available 'bits and pieces' of relevant information and experience, dismissing nothing seen as relevant or important –through observation, questioning, collation, bundling, forming composite pictures surrounding controversies and other interesting educational scenarios. Nothing is dismissed till the conscious choice of content is seen as irrelevant.

The author uses summaries, surveys, questionnaires and other familiar processes, of students, teachers and community members. I can ask about existing, past, present, different educational ideas, teaching-learning processes – using community and domain languages in communication, within subject areas – to identify specializations, improvements, and so support each student, each teacher, each researcher.

These activities build up an emerging picture of information, knowledge and skills which allow for refreshed and reframed ideas and processes to focus further on student needs in diverse circumstances and in global situations. The content, the concepts, the teaching-learning process: all these elements provide and allow for a balanced self-understanding which emerges as auto-ethnographic skills, and consequent nuances are honed as part of the business of mature teaching.

Auto Ethnography – Components: Narratives, Narrative Analyses

Given the massive changes and political eddies that have inhabited our twenty-first century world, the value of narrative comes to the fore. Change is experienced through natural disaster, through forced political catastrophes, even through geographic placement on our planet. Uniqueness of individual experience and response is acknowledged through the use of personal narratives. Personal accounts about learning through experience respect the individual, especially a teacher or a student, but also allow for the inclusion of opportunity to hear how diverse life can be. Emergent themes can provide possible pathways as we shape our personal storylines, valuing our lived experience, and sometimes sharing that lived experience in the process of teaching (Roth, 2005, pp. 379–423). When analysing such chunks of our own lived experience, we discover attitudes and beliefs based on particular lived experience and so maturity progresses, and we find others who exhibit the similar position on vexed topics current in our cultural milieux. We speak of what is important to self, and find others who agree. The underlying theme of teaching and learning as a feature of the larger concept of Edu-tensegrity also contains the relevant expertise and specialisations that students need as they prepare for their own future which will at all times be so different to that of their teachers.

Where necessary, transcriptions and translations of personal accounts can yield dramatic content to promote accurate global learning. By analysing those narratives, we provide opportunities for the fashioning of Inductive Data Reduction charts to be compiled: inductive thinking allows themes and concepts and outcomes to emerge from the raw data. This provides for refreshing and reshaping existing practices for the betterment of the teaching-learning processes (Splitter & Sharp, 1995).

Philosophy for Children (Lipman, 1988) has provided an enduring history in which students are able to listen to each other, to the teacher or expert, to ask questions, to develop understandings, and to open the possibilities likely to result in student choices – for managing their understanding of what counts as virtues, values and ethics for them. Decision-making is thereby practical, independent and relevant to student needs. In today's uncertain and evolving conditions, there is need to recognise that the unbalance we face, needs particular action, and research is the first step in choosing interim and longer lasting impact on confusing and unjust phenomena today.

We are already aware that there is evidence of a dramatic level of climate change. We can't go back to life as it was even ten or twenty years ago. Contentious issues like human trafficking, brutal racism, blatant colonialism, child sex abuse, degradation of oceans, and more need remedial and restorative action immediately on a massive scale. The education of tomorrow's decision-makers will need to provide them with the tools they use to choose positions that are positive, clear-sighted, manageable and based on sufficient scientific evidence to produce outcomes that manage or solve these massive global issues. Action to the contrary will result in global failed states and the trashing of democracy. Reference to the relevant papers contributed by experts whose knowledge and lived experience highlight vexed 21st century issues (Heasly, 2020a) also model the processes being advocated within this paper.

Conclusions and the Impetus for a Better Future

We can but acknowledge how the evolutionary cycle of the universe and the present clash of difficulties like the corona virus pandemic, coupled with brutal racism, the rise

of greed and corruption, and the presence of the politics of disruption, pushes our various cultural and national lived experience towards the solving of problems, the managing of paradoxes, the urgency for paradigm changes. Blurring the lines and boundaries of different branches of modern sciences and inclusion of social well-being as a central issue prompts us to recognise how Edu-tensegrity allows for a refreshed and rejuvenated approach to education based on sustainability and securitability. Inclusion of the diversity of religious belief and ideological ideas must be part of the mix, if Education enterprises are to address the present discomfort, mental ill-health and emotional distress, apparent today. Virtues like respect for every person, Values like the retention of democratic procedures in all walks of life, and Ethics like restorative justice and care for people and our ailing planet, indicate the way forward without going back to a rigid attention to binary thinking that grew after the Industrial Revolution in the last three centuries.

Within this Sustainability and Securitability agenda, it is pleasing to note the work Giedrė Slusnienė (2020) has researched in Lithuania: 'Possibilities for Development of Emotional Intelligence in Childhood in the Context of Sustainable Education'. This was related in full in the Discourse and Communication for Sustainable Education journal, vol. 11, issue 1. The conclusions reached in the research outcomes open the way to further aid in the blurring of rigid boundaries of particular educational domains with which we have been familiar.

This area of educational research is ably partnered by Geikina and Balode (2020) in Latvia, whose research is vital to the balance of the concept of Edu-tensegrity. The emphasis on dialogue parallels the Community of Inquiry approach to classroom practice first formalised by Matthew Lipman late in 20th century educational practice. This was incorporated fully into my research described in the thesis (2012) and informs my subsequent research to explain the concept of Edu-tensegrity. The inclusion of the Millennium goals of UNESCO with the concept of Sustainability is defined fully (p. 148) of the Virtues, Values and Ethics of my thesis, and the various diverse conceptual triangles designed and explained, applied and modelled throughout.

I have tried to bridge the boundaries of different branches of science to include the newer discoveries in many branches of educational endeavour. Lived experience is a valuable component especially when shaped with discipline into auto-ethnography, and research into the theories of knowledge from different disciplinary domains has been a helpful tool in this journey. The next step in researching the usefulness of the Heasly Thinking Skills System will necessarily be to shape a pilot research project and paper that tests out the development of skills, knowledge and inquiry to accommodate today's post-pandemic, expanding digital conditions as our paradigms change and become settled and balanced in a legacy for coming generations (Heasly et al., 2021).

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