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Industry 4.0, Democracy and Education: What These Mean for School Culture and Leadership Right Now?

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It is widely acknowledged that our world is in transition from the third to the fourth stage of the industrial revolution (Industry 4.0). From a world influenced by electronics, computers and automated manufacturing to one that will be influenced by cyber-physical systems in which real objects and virtual processes are interlinked. But getting to this fourth stage is not solely dependent upon technological developments, particular sociocultural changes will be required, too. As artificial intelligence, the internet-of-things, and machine learning dramatically change the nature of work, it is argued that, for the longer-term sustainability of humankind, enhanced interpersonal sociability, cultural democracy and moral integrity will become essential counterbalancing forces of an otherwise isolated and independent lifestyle. Hence, this article argues that a major challenge for today's schools is the need to prepare students for such a different sociocultural environment. This involves more than learning about interpersonal sociability, cultural democracy and morality. Preparing today's students for full participation in an Industry 4.0 world means that they must learn not only about interpersonal sociability, democracy and morality but also by being immersed within a school culture that unequivocally embodies these concepts. To this end, we argue that the latter requirement is unlikely for many of today's students because not only are schools' physical and organisational structures still largely aligned with an Industry 2.0 world, but also their leadership practices and organisational cultures are as well. Arguably, such practices and the individualistic cultures created by them are mostly composed from discrete entities joined together by pragmatic processes, so that relative discontinuity and independence rather than connectivity and interdependence are commonly found. Preparing students for Industry 4.0 demands changing these leadership and cultural tendencies. This paper describes ongoing research that seeks to accomplish these outcomes by means of a unique ecological exploration of school leadership and school culture where the quality of relationships becomes the pivotal focus.

Keywords: fourth industrial revolution, school leadership, transrelational leadership, school culture, organisational ecology

Introduction

It is widely acknowledged that our world is in transition from the third to the fourth stage of the industrial revolution (Industry 4.0). From an Industry 3.0 world influenced by electronics, computers and automated manufacturing to one that will be influenced by cyber-physical systems in which real objects and virtual processes are interlinked.

But getting to this fourth stage is not solely dependent upon technological developments because particular sociocultural changes will be required, too. As artificial intelligence, the internet-of-things, and machine learning dramatically change the nature of work, it is argued that, for the longer-term sustainability of humankind, enhanced interpersonal sociability, cultural democracy and moral integrity will become essential counterbalancing forces of an otherwise isolated and independent lifestyle. In other words, preparing today's students for full participation in an Industry 4.0 world means that they must learn not only the effective career oriented knowledge and skills to enable them to be gainfully involved in a highly technologically influenced world, but also the affective knowledge and skills associated with interpersonal sociability, democracy and morality.

While most of the Industry 4.0 associated literature focuses on the radically positive technological innovations likely to be generated, some also raise concerns about the potential negative effects that this fast growth in technological development and digitization will have on individuals and society (Luppicini 2012). Although this paper will focus on these potentially negative effects in order to establish an argument in support of what might be considered as mediatory educational changes required now so as to better prepare today's students for the Industry 4.0 world, this should not be interpreted as an antagonistic treatise condemning the anticipated technological innovations. The aim is rather to strive towards developing the essential balance between technological and socio-cultural innovations required to ensure the anticipated Industry 4.0 benefits are able to be fully realized. This is to argue that, although the Industry 4.0 revolution might have the potential to reconstruct the idea of work as well as the nature of work, its more widespread consequences are not necessarily inevitable. If adequately prepared through education, future workers and employers can use the promise of the new technologies to shape socially and individually fulfilling responses, rather than be passive

recipients of the consequences. This means that today's students must be taught the socio-cultural skills and dispositions to deal with such challenges.

To this end, it is posited that the following three general capabilities will be required of people in an Industry 4.0 world. First, although it is presumed that machines will be doing most of the routine work, we have not yet been able to automate tasks that demand human qualities that relate to thinking and feeling. This means that in the near future people will need to develop and use thinking skills such as critical thinking, judgement, creativity, computational thinking, problem-solving and communication. Secondly, if this means that people will be spending less time on routine individual tasks and more time working with others, including working for more than one employer in different settings, then they will need to have skills for collaboration, team work and interpersonal relations. Thirdly, as machines replace people in most routine and repetitive type tasks, it will then be essential for the people to be mindful of protecting working conditions, help to shape the extent of automation as applied to jobs, and prevent the digital revolution from widening inequalities. To this end, people will need to possess knowledge about their socio-cultural environment in order to be able to exercise such political skills as lobbying, advocacy and networking, to be respectful and empathetic of difference, and to have interpersonal skills and a disposition to work for the common good.

We argue that such capabilities are the manifestations of a sincere and dedicated commitment to the principles of democracy. A person with knowledge, skills and sincere dedication to a fully democratic society firmly believes in the creation of a civil society formed out of widespread inclusive interpersonal relationships, which connects diverse peoples in a consensual and cooperative way so as to bring about order and stability. Such a person acknowledges themselves and others as being both rational and moral where just because something can be done does not immediately imply that it should be done. Given the encouragement, opportunity and right environment, each person is capable of compromising self-interests for the common good. Within a fully democratic society, which will be essential in Industry 4.0, the primacy of individualism is replaced by collectivism in which highly desired personal benefits are only gained through teamwork and networking with others.

However, gaining such democratic knowledge and skills re-

quires more than cognitive engagement with pragmatical implications. These need to be learned through immersion in real life experience (Bond 2016). We argue that this implies that today's students need to learn them within a school culture that unequivocally teaches and embodies these concepts. Hence, this paper describes ongoing research that seeks to accomplish this outcome by means of a unique ecological exploration of school leadership and culture where the quality of relationships becomes the pivotal focus of study.

Industry 4.0 and Its Less Prominent Implications

One of the early promises of the digital revolution was that it would enhance democracy. In contrast with pre-internet times, it was claimed that the internet provided access to a greater range of news outlets and so would diminish the power of a small number of media monopolies; and at the same time, it would foster political participation by enabling people to express their views to a much wider audience (Reid 2018). Indeed, Rifkin (2014) went further and argued that the internet would become a 'collective commons' in which anyone can post, download and read material for the purposes of sharing for the collective good. Notwithstanding the achievement of such positive possibilities, the digital revolution is also posing a number of dangers to some of the key features of democracy that can only diminish, rather than democratise, the public sphere (Runciman 2018).

A major concern is the negative impact that the digital revolution is having on our democratic election processes. At the heart of the problem is big data, which works by gathering large amounts of personal data from social media and using a powerful algorithm to analyse it to develop detailed profiles of individual voters. This enables political parties to identify each voter's emotional triggers and so tailor messages to suit each profile. One high-profile example is that of Cambridge Analytica, the data mining and analysis company which, without authorisation, took personal Facebook data gathered from 50 million Americans in order to target them with personalized political advertisements during the 2016 American Presidential elections (Cadwalladr and Graham-Harrison 2018).

A broader but related concern about social media relates to its tendency to drive people into like groups where their opinions and beliefs are constantly reinforced (Reid 2018). This encourages

people towards only talking to others with similar views so that biases are being confirmed and alternative views are not being seriously considered (Hull 2017). Already, our communication technology is moving people towards rarely being exposed to points of view that vary from their own, so that they are becoming isolated in their own view of the world (Pariser 2011), thereby closing their minds and reducing the possibility of being able to participate in a truly democratic discourse. Moreover, the quality of democratic discourse in the public sphere is also reduced by the proliferation of fake news and conspiracy theories, which are fanned by the speed and reach of the internet (Reid 2018). Interestingly, the 2018 Freedom House Report, which compiles an authoritative report on the state of democracy around the world, claimed that in 2017 democracy faced its most serious crisis in decades as the fundamental conditions of free and fair elections, the rights of minorities, freedom of the press and the rule of law came under attack around the world.

Clearly, the time is right for this threat to democracy to be not only acknowledged but also overcome. The fourth industrial revolution will have the potential to enhance our democracy but at the same time it is likely to contain the seeds of its further downfall unless action is taken now. To this end, it is argued that a pivotal purpose of education today is to reinforce and invigorate our socio-political democratic processes now and into the future. It is essential that today's students learn how to be actively engaged Industry 4.0 citizens with the aptitude and competence to ensure that technological innovations are only introduced and used for the common good.

According to Reid (2018), in order to ensure that students gain such an aptitude and competence, they need to gain the following capacities. First, they need to gain knowledge and understanding about democratic life. If some of the fundamental tenets of democracy are under threat, the first step in overcoming the dangers is for the citizenry to understand what needs to be defended and why. This suggests that it is getting more and more important for our students to understand our democratic system, its origins, history, institutions, processes and values. This understanding should not be static, but one that enables our students to recognize how to improve democratic processes or institutions in ways which are consistent with the basic principles of democracy. But such understanding must come with the competence and commitment to be actively engaged in civic and political affairs, especially those that

have the capacity to undermine social cohesion and democratic processes.

This necessitates the need for the person to be skilled in capacities of discernment and scepticism (Reid 2018). If factors such as fake news and hyper-individualised targeting at elections are likely to become even more prevalent in an Industry 4.0 world through technological innovations, then the citizens of such a world will need strategies to recognise and resist them (Susaria 2018). This suggests that we need to be able to support our students' learning of skills enabling them to discern propaganda, identify the authority of any source, weigh up evidence, and be sceptical about unsubstantiated or biased claims. But, at the same time, be open to engaging, and learning from different views and beliefs. If the problem associates with social media, whereby it has a tendency to strengthen personal biases because it encourages people to only communicate with others with similar views, then, in order to safeguard democracy, an Industry 4.0 citizen will require the aptitude and competence to actively avoid such an unhealthy outcome by willingly seeking out alternative views and to engage in respectful discussion about them.

However, Reid (2018) wisely points out that the capacities of discernment and scepticism must also be directed towards the biased perspectives, possibly concealed in modern media news scripts and corporate advertising. Where self-interests are disguised as community interest or benefits, and lead to superficial consideration of disparate issues, then today's students need to develop strategies that allow them to discern authentic local, national and global trends, to reflect on the socio-cultural implication of these in depth, and to take appropriate constructive action whenever deemed crucial. This necessitates a sincere sense of society, distinct from individualism, and a firm moral commitment to the common good. It is crucial that, in democracy, its citizens have a commitment to think beyond themselves and consider benefits to the wider community. This will be particularly evident in situations where the introduction of machine learning innovations has the potential to cause unemployment, often for those least prepared to cope with it.

Although it is true that teaching of such democracy aligned aptitudes and competencies is not new, the unique departure point for this research is its view that such learning must be inclusive of lived as well as cognitive experience. To ensure the deepest learning of these aptitudes and competencies requires the student to

learn about, and to learn from within, all that constitutes an authentic democratic environment. To learn about democratic values, theories and principles, while simultaneously learning within a school culture that truly imbues democracy in action. It is argued that this is rarely the case in our current schools in which the administrative structure and functioning are more akin to that of an Industry 2.0 factory than what is required within an Industry 4.0 society. Moreover, we argue that in order to transform the school culture towards a far richer democratic learning space, it is essential to change the way we review and understand their functioning. To this end, this paper promotes and describes the application of an ecologically informed process for exploring and informing a school's culture. A process in which the focus is more upon internal and external relationships than it is upon specific roles and practices.

The Theoretical Foundations of the Ecological Research

What this paper has argued to date is that today's students need to learn these within a school culture that unequivocally teaches and embodies democratic concepts if they are to be adequately prepared to fully and effectively prosper in an Industry 4.0 world. To this end, this paper describes ongoing research that is accomplishing this outcome by means of a unique ecological interpretation of school leadership and culture where the quality of relationships becomes the pivotal focus of study. But such a unique interpretation must be founded upon credible and reputable theoretical principles.

Potential possibilities can only be fully achieved when people truly connect with each other to create a shared understanding of the core purpose of their work (Senge 1990). Such a widely shared understanding cultivates a profound personal commitment because each person knows the important contribution they provide to the achievement of this core purpose. Genuinely connected people create a fertile ground for productive professional relationships founded upon the values of respect, inclusion, openness and collaboration. These values enable people to earnestly listen, learn and work closely with each other so that the organization can be confident in its capacity to fully achieve its core purpose.

However, such connectedness is rare because its achievement is not sufficiently appreciated. Hence, workplace cultures are more likely to form pockets of disconnected groups and individu-

als. Within these cultures, relationships tend to become competitive and exclusive, and fall well short in promoting the values of respect, inclusion, openness and collaboration. Rather than working together to realise the potential of the organization, some become disengaged in their work; they do the minimum and they limit their social interaction with their colleagues and clients. Each time this happens, the energy that drives the organisation's potential is lost, and the core purpose achievement level is significantly diminished. Moreover, many leaders are often ill equipped to understand the complex causes of these cultural issues and therefore struggle to know how to overcome them.

To date, practical ways to manage, control and artificially orchestrate collaboration and performance have dominated the advice to leaders on how to fix these problems. But this has produced little success. Rather than striving to impose collaboration upon a culture, the ecosystem approach seeks to understand the culture and to find out what is currently diminishing collaboration and performance. Essentially, this entails learning about: (1) the degree to which there is a clearly articulated shared understanding of the core purpose; (2) the ways in which the people are personally and professionally interacting in their workplace; (3) the cultural norms, values and beliefs that are driving these relationships and interactions; (4) the existing factors that are motivating the people at work; and (5) the influence of the leaders within this culture. These five factors underpin our ecological approach as it seeks to illuminate any habits and practices that are limiting interconnectedness and diminishing core purpose achievement.

Describing the Ecological Research Approach

Specific to the context of our research in schools, once there has been an exploration of understandings in relation to the school's core purpose, an investigation occurs into the quality, diversity and extent of interconnectedness both within the school, as well as between the school and its community. During this investigation, judgements about interconnectedness are developed based on data gathered pertaining to the presence or otherwise of the following elements within existing relationships (table 1). These elements are seen as energy factors that are able to drive the school's processes for growing and developing its students. It is argued that if this energy is reduced through the presence of some disconnections, the beneficial outcomes for students are reduced. Where the

TABLE 1   Key Elements of a Postive Relationship

Compassion/care	Harmony
Information sharing	Collaboration
Commitment to Mission	Respect
Responsibility to Contextual Character	Shared values and beliefs

energy flow is optimised through strong and extensive intercon-
nectedness, the beneficial outcomes for students are maximised.
An appreciation of the important influence that interconnected-
ness plays in a school's productivity can be shown diagrammatic-
ally as in figure 1.

Importantly, this figure is an illustration rather than a detailed
map of a school's culture. A detailed map would be far too com-
plicated. However, in the case of an actual school research site,
the illustration would have some additional detail in order to show
its closer alignment to the case in question, and not every arrow
would be either dark grey in colour or double-headed. As such, the
adjusted illustration would more clearly show the relative level of
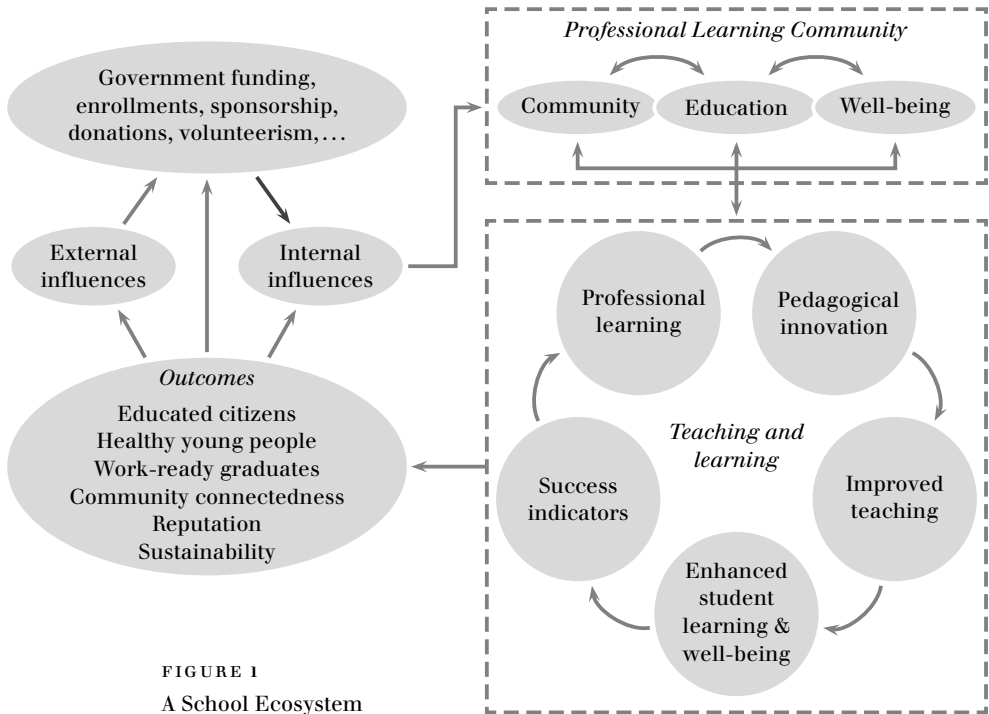effective and efficient interconnectedness as indicated by the col-

FIGURE 1
A School Ecosystem

our and direction of the arrows joining each part of the culture. Dark grey arrow indicates stronger interconnectedness than light grey arrows. Double headed arrows indicate excellent communication that goes both ways (i.e. strong interconnectedness), as distinct from single headed arrows which indicate that the communication is predominantly in the direction shown by the arrowhead. Thus, the figure illustrates the perception provided by the data that achievement of the school's desired educational outcomes is being significantly compromised by a lack of appropriate professional interconnectedness throughout the culture.

Research Methods

Informed by the focus of this particular research being centred upon personal constructions, interpretations and perceptions of the quality of relational interconnectedness throughout the school, a qualitative research being underpinned by a social constructionist epistemology is adopted (Gergen 2015). Such an approach acknowledges the subjectivity of personal constructions, interpretations and explanations associated with common lived realities, yet these also enable the explication of generalised beliefs, perspectives and understandings. Hence, this research incorporates a case study methodology which gathers a rich array of data from individual interviews, focus group interviews, an online staff survey, and document reviews.

A Constant Comparative Analysis (CCA) method is then used to consolidate, reduce, and interpret all of this data so that a rich and comprehensive understanding of it is gleaned. This data analysis method enables commonly held cultural insights to emerge from each interviewee's reported interpretations and constructions of their reality, since these are grouped around common experiences and perceptions to form overarching impressions (Merriam nad Tisdell 2016). Essentially, this CCA method employs open and axial coding as well as triangulation of data sources, which, together, enables patterns of convergent understandings, perceptions, values and beliefs about the school's leadership and culture to emerge.

Research Outcomes

Given that each school explored by this ecological approach is a case study, no generalizable or universal truths about school leadership and culture are possible. But deep insights into the unique

capacity of the approach to discover and illustrate the array of current leadership and cultural strengths and weaknesses in a case school is clearly discernible. For example, the most recent research school was an Australian rural co-educational secondary school with an enrollment of approximately 1000 students and 81 members of staff. Although this school had maintained a very positive reputation in its local community throughout its 50 years, there was a growing perception amongst the staff, students, and parents that this was now under threat. Despite all the efforts being made to sustain the school's reputation, student enrollment was decreasing. A growing number of students were even seeking to complete their final two years of secondary education at other available schools. Furthermore, a strongly held concern amongst those associated with the school community was that the school's culture had become outdated. Essentially their view was that the school's culture, with emphasis on senior academic achievements, the elite status of certain traditional subjects, and a very hierarchical and authoritarian administrative structure, needed to be replaced by one that was far more holistically inclusive, equitable and relational.

But the serious challenge for this school community was twofold. The first serious challenge for the school was in determining whether or not this view was correctly defining the problem and, thereby, promoting the best solution. Then, the second serious challenge, if this view was correct, was in determining how to successfully change the culture. Without relevant data the leaders of this school community were not in a position to address either of these two serious challenges. The aim of the research was not only to address both of these serious challenges but also to provide some clear direction for how the school could overcome whatever unhelpful leadership and cultural issues that were present.

The implemented ecological review of this school occurred within five school days, which saw a total of 77 persons – staff, students, parents, education system personnel, or key community stakeholders – being involved in an interview either individually or as a member of a focus group. In addition, 58% of the school staff completed the online survey. Data gathered in this way were then cross-referenced with that provided in official school documents including vision and mission statements, school prospectus, position descriptions, publicity brochures, school policies, strategic planning documents, and school newsletters.

As a resultant of the data analysis procedures, data not only un-

equivocally substantiated the view of the school's culture as being outdated but also the following five leadership and cultural themes were determined as being key foci when implementing the desired cultural change: (1) A Compelling Vision, Mission and Purpose; (2) Educational Priorities and Strategies; (3) Structure and Function Primacies; (4) College Reputation and Promotion; and (5) Strategic System Support. Moreover, this ecological approach enabled us to use data to highlight both commendations and recommendation within each of these cultural themes. In total, this ecological review produced 17 commendations and 25 recommendations. In other words, this unique school review approach was able to explicate, with data-informed justification, some crucially significant cultural elements undermining not only the effectiveness of the school in achieving its Mission but also the democratic working environment.

For example, data pertaining to the Structure and Functioning Primacies clearly highlighted such dysfunctionality with the Curriculum Coordinators' Committee at multiple levels. At the level of purpose, the diverse views of members of this committee included comments such as, 'the purpose of [this committee] is not clear,' while another proposed that the purpose 'is about resources and exam results' but another claimed it was 'about nuts and bolts – not long-term thinking.' Arguably though, far more serious views were presented in regard to the functioning of the committee. A serious concern included the view that although the purpose of the committee was to enhance communication between the school's leadership team and its subject-based middle leaders, so as to improve decision-making, in effect 'most decisions are already made and we [the committee members] are merely left to enact these decisions.' But it also included concerning views about the actual non-democratic tone of the meeting. One committee member described the tone as being 'adversarial and provocative' and another as 'contentious and confronting' and a third member described it as 'tense, protectionist and challenging.'

Data from the staff survey supported the understanding that many of these curriculum coordinators were relocating similar undemocratic values and behaviours into the subject teacher team meeting which they coordinated. Only 20% of staff believed that there were positive professional relationships in the functioning of their subject team, while more specific data suggested that only 13% of staff had personally experienced feelings of inclusiveness and reciprocity as a member of a subject teacher team. Also, 40%

of staff were concerned that their curriculum coordinator did not communicate effectively with them on a regular basis.

While ethical considerations for anonymity and confidentially prevent further detailing of these commendations and recommendations, it is vitally important to note the capacity of this ecological approach to produce considerable numbers of both commendations and recommendations. A potential major concern when implementing any leadership or cultural change strategy is to be confident that one is not only overcoming an unhelpful element but also not undermining a beneficial one simultaneously. This ecological approach ensures that the school recognises not only those leadership and cultural elements that need to change but also those that need to be kept. Furthermore, by providing a rich array of data in support of the description of the elements needing to be changed, there is far less room for disagreement or discredit. Finally, guided by the data and such descriptions, it is far clearer as to how such unhelpful leadership and cultural elements can be changed.

Arguably, however, the extraordinary effectiveness of this unique ecological approach to school reviews, being able to provide comprehensive, clear, precise, and defensible school review commendations and recommendations is best proffered by the Executive Director of the authority tasked with overseeing the administration of this particular educational system. This person wrote that the Review Report, 'captured the school culture very well. The detail and the elaboration provided was presented with great clarity. [...] Being comprehensive in nature, it has enabled a detailed Action Plan to be developed by the school in consultation with Office based staff. [...] The commendations and recommendations have been fully embraced by the school leadership and the Office based staff and have been the basis for the development of a strategic action plan to assist in driving the necessary improvements in the school culture. One key action is being undertaken in this first week of the school year, with an external facilitator leading the staff in a process to reflect upon and renew their Vision/Mission/Values.'

Concluding Discussion

While it is true that the aim of this research was not explicitly focused on establishing democratic leadership and culture within the school, the outcome generated by the ecological review pro-

cess was. Essentially, the aim of the review process was to determine the actual reason why students were leaving the school and how this enrollment decline can be turned around. What the ecological review process established was that the school's leadership and culture was deemed by a rapidly growing number of students and parents to be outdated and no longer suitable. Simply stated, the leadership and culture were often considered to be far too authoritarian, elitist, inequitable, and non-inclusive. Indeed, the ecological review process was able to readily provide a rich array of data describing and supporting these perceptions. Moreover, as this data not only captured many participants' common impressions about the school's leadership and culture but also their reasons for having such impressions along with their views about what they would like to see changed, the ecological review process effectually developed a comprehensive list of both the highly beneficial and the decidedly constraining elements within the current leadership and culture.

Importantly, however, when considered together the actions required to both maintain the beneficial elements while redressing the constraining elements resulted in the creating of a far more democratic educational environment. This dual focus sought to develop a far more inclusive, equitable, open, ethical and empathetic learning and teaching environment. A school in which every person's voice is heard and listened to for understanding so that decisions can be transparently based upon a commitment to the common good. More specifically, the outcomes generated by this ecological approach to the review of the school's leadership and culture sought to create a far more ordered and stable learning and teaching environment. An environment dependent on a widespread commitment to inclusive interpersonal relationships in which diverse opinions, views and experience were provided, heard and considered in a consensual, cooperative and genuine way. This was aimed at replacing the existing individualistic culture with a collective culture whereby teamwork and interpersonal connectivity became the path to sustainability and success. Hence, these outcomes generated a far more democratic school culture founded upon leaders, staff, students and parents enacting democratic principles.

Thus, we argue that, as our world moves towards Industry 4.0, all schools will need to seek a way to adopt a similarly democratic learning and teaching environment in order to ensure that today's students are adequately prepared to live by authentic democratic principles. Achieving such an essential environment will be a

significant challenge for many schools and school systems, because little has changed with respect to how schools are led, administered and structured since early last century during Industry 2.0. This being so, finding a practical and manageable means for overcoming this challenge is crucial. Our ecological school review process undeniably meets this challenge.

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