

## **The Impact of Powerful Economic Forces on Macao's Secondary Schools: A Complexity Theory Perspective**

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**Abstract:** There has been a recent revolution in Macao's economic activity, with the rapid development of the casino industry, and corresponding enterprises such as travel, tourism, hotels and restaurants. The employment market is having a direct effect on the education system, as secondary school students leave their junior high schools in order to enter casino work, believing that it requires low effort yet brings swift monetary returns. The Macao government provides free education only up to Form 3, so students who are doing poorly or who have been repeating one or more years in school, when they reach the age of 18, receive their parents' permission to seek employment rather than furthering their studies, thereby relieving parents of their need to pay expensive school tuition fees. This paper indicates how the situation in Macao can be explained by complexity theory, and how the theory can identify ameliorative steps to be taken. Implications for parental involvement in education are drawn, and greater networking and communication with parents are argued to be crucial elements for improving the present situation in schooling. Preliminary results of empirical research into this are presented.

**Keywords:** Macao, Education System, Complexity Theory, Parental Involvement

### **Introduction**

With Macao's handover to the People's Republic of China in 1999, and its becoming a Special Administrative Region, Macao's economy has developed very rapidly and has become much stronger, with very considerable foreign investment in gaming and tourism. The positive outcomes of this can be seen in enhanced employment opportunities. On the other hand, it has created severe strains on Macao's secondary schools. As a consequence of the economic upturn, the conservative practices of many secondary schools in Macau, together with other environmental factors like political and social aspects, have shown that Macao's secondary schools are in need to rapid and significant change. In Macao teachers and students are leaving school in large numbers to go to work in the gaming industry; schools have to find teachers in order to receive subsidy from the government, and schools increasingly are having to solve social problems that stem from, or are introduced by, the parents.

Complexity theory may be useful here, not only in diagnosing the situation in Macao, but also in suggesting remedies. Complexity theory, predicated on an open systems view – in

this case of schools – suggests that Macao’s secondary schools hitherto have operated very largely as closed systems, often disconnected from the external environment of Macao, and with very limited parental connection, and so, when faced with external problems that the parents bring to school, are unprepared and not yet fully capable of handling the situation.

The argument in the paper is that Macao’s secondary schools need to open themselves to the outside environment rather than isolating themselves from the environment. Further, in line with complexity theory’s implied advocacy of schools opening themselves to the environment, the question that is raised is ‘to which environments schools should open themselves?’. Here a diagnosis is made of one of the difficulties that Macao’s secondary schools face: they have opened themselves in part to external environments, but have done so *selectively*, focusing on, for example economic, employment, higher education and political environments, and neglecting equally important, if not more important environments such as human, community, moral and social external environments. As such, they are ill-equipped to meet the demands that parents are now placing on them, to assist in the solution of problems caused by the changing economic environments, not least of which are gaming and its negative consequences on families in Macao. The argument is advanced that, whilst it is laudable that Macao’s secondary schools open themselves to the external environments, they should do so judiciously, taking account of the need to include moral, social and domestic dimensions. Schools in Macao, although aware of the social problems brought to them by, and concerning, parents, are not well positioned to respond to these, as, by virtue of their traditional remoteness from parents, they have little experience in handling such issues. With little or no experience of connectivity with the parents, schools have neglected crucial environmental factors: social, moral, communitarian, familial and interpersonal.

Further, changes in Macao’s economic development have impacted on the next generation, placing it at risk, for example, by the increase in low skill employment (e.g. in casinos and tourism), inadequate entrance to higher education, lack of career advancement, and short-term thinking. Gradually the employment market will shift such that, if steps are not taken to reverse the situation, an insufficient number of new professionals will emerge in Macao, and this could contribute to a spiraling down of the economy, the social, community and family situations in Macao.

### **The economic background of Macao**

The Sino-Portuguese Joint Declaration on the Question of Macao was signed in Beijing 1987, under the agreement between Portugal and the People’s Republic of China. The settlement set the stage for the return of Macao to become a Special Administrative Region (SAR) of China after the handover in 1999. The handover of Macao represented the ending

of the Portuguese administration for more than four hundred years. Since the handover of Macao, the Central People's Government of the People's Republic of China has assisted Macao's economy by signing the Closer Economic Partnership Arrangement CEPA in 2003. The CEPA is designed to strengthen trade and investment cooperation between Mainland China and Macao and to promote the joint development of the two sides; the ultimate goal is to promote trade and investment facilitation such as services, tourist resorts, products and other attractions of Macao, through reduction in tariffs. This is one strand of the economy.

A second strand of the economy is gaming and tourism. The economy of Macao is based largely on tourism and gambling. The tourist sector accounts for some 25% of Macao's GDP, while revenue from the gambling business represents over 40% of its GDP. More than 18 million tourists visited Macao in 2005. The casino industry had run under the monopoly of the Sociedade de Turismo e Diversoes de Macau (STDM) for 39 years. This was ended in 2001 when casino licenses were offered to other casino operators, leading to the involvement of major international groups and consortia, for example the Las Vegas Sands, Wynn resorts, the Galaxy and MGM resorts and casinos. Grand casinos, such as the Sands Macau and Waldo opened in 2004, the Wynn Macau opened in 2006, and the Venetian Macau is due to open in 2007. The total gambling capacity, measured in gaming tables, is estimated to grow by some 300% in the short- to mid-term. Macau's explosive double-digit economic boom began in 2003. The GDP growth in 2004, of 28%, was driven by foreign investment (as mentioned above), associated with the expansion of the gaming and related industries such as hotels and restaurants.

The unemployment rate in Macao has been decreasing progressively over the last few years (Table 1). The labor market in Macao has shifted gradually to heavy reliance on the casino-related industries. The labor force moved dramatically, with the figures from the Government of Macao SAR's Statistics and Census Service indicating that the distribution of the employed population by economic activity, and that industries such as manufacturing and wholesale, retail, repair, hotels and restaurants decreased while the construction, social and personal services, including gaming, increased from 2003 to 2005 (Table 2). The construction industry has increased rapidly with the building of huge casinos, and the building unit transactions for commercial use increased 34.3% in respect of the year 2003.

Table 1: *Labour and Employment*

	2003	2004	2005
Labour force participation rate	60.9%	61.9%	63.1%
Unemployment rate	6.0	4.8	4.1
Employment population	202,600	218,000	237,800

(Data retrieved from the web of Government of Macao SAR, Statistics and Census Service)

Table 2: *Distribution of Employed Population by Economic Activity*

	2003	2004	2005
Manufacturing	18.3	16.4	14.9
Wholesale, retail, repair, hotels & restaurants	27.1	27.1	25.4
Construction	8.0	8.3	9.7
Social & Personal Services (Including Gaming)	29.5	31.8	34.1

*(Figures are in thousands)*

(Data retrieved from the web of Government of Macao SAR, Statistics and Census Service)

Changes in the nature and amount of employment abound in Macao. Schools have to respond.

### **The Current Education System in Macao**

Schools in Macao are divided into private, public and subsidized schools. Among them, there are only a few government schools. The private and subsidized schools are further separated into religious, non-religious, international, and pro-China schools. A basic ten-year compulsory, free education is offered to students in Macao (Figure 1). There are a few vocational schools in Macao, offering technical subjects such as car repair, electronics, electrical engineering, etc.

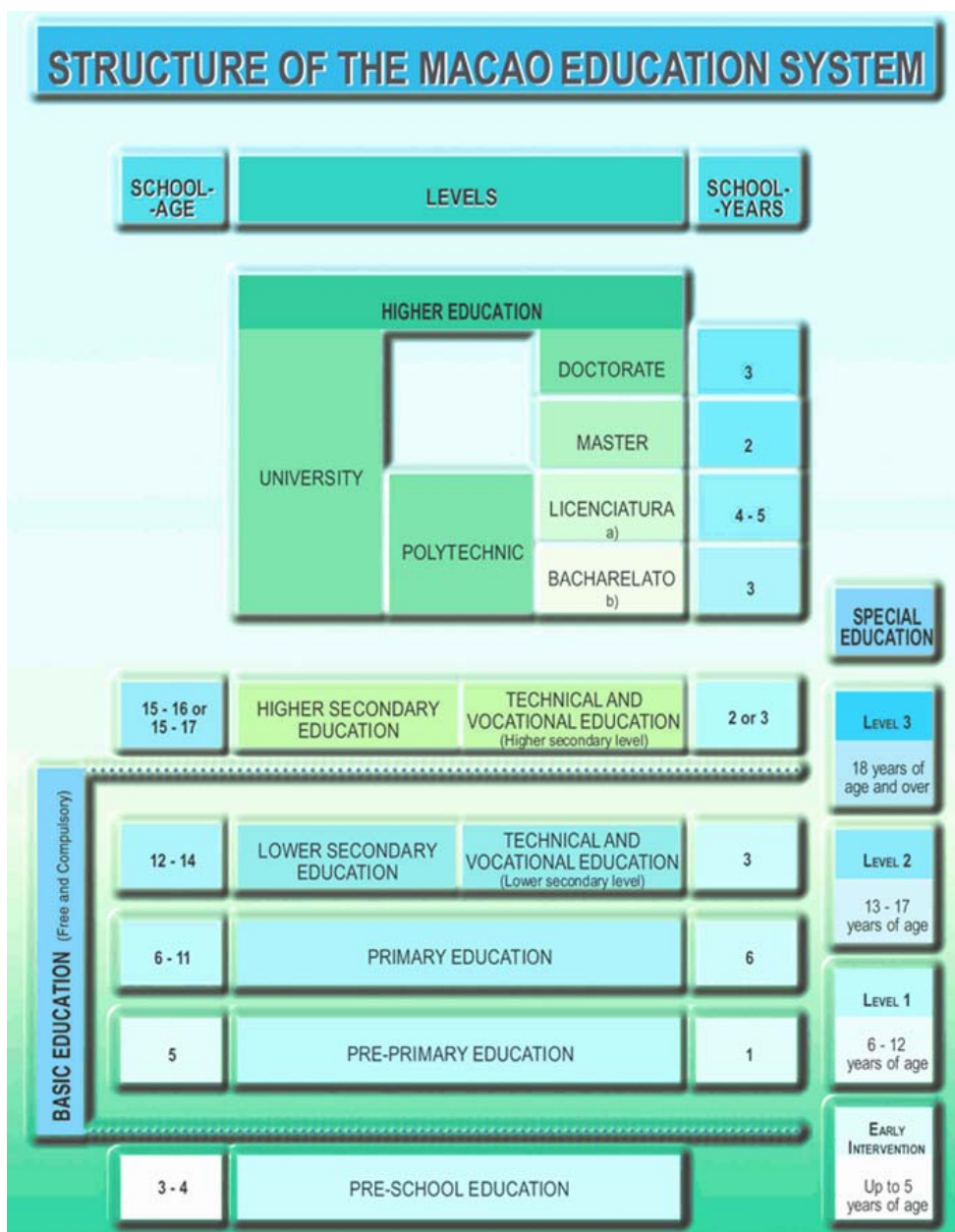


Figure 1: Structure of the Macao Education System

(Figure retrieved from the Bureau of Education and Youth of the Macao SAR)

The majority of the schools in Macao are offering Chinese and English languages. Portuguese is also taught in some of the schools, and only the government schools and one private school offer Portuguese and Chinese as the medium of instruction. Mandarin is widely taught in most Macao schools.

Macao does not possess a common education system. Schools in Macao follow different curricula that reflect their goals and visions and countries of origin. Generally speaking, there are four different types of education system: the Chinese educational system (including those of mainland China, Hong Kong and Taiwan), the British or Canadian

educational system, the Portuguese educational system, and the international school educational system.

In those secondary schools adopting the Chinese educational system, students focus their studies on applying for higher education in Taiwan and Mainland China, therefore, their curriculum often parallels those in Mainland China and Taiwan. Students in those schools use textbooks from China and which are printed in simplified Chinese.

In those schools adopting the British or Canadian educational system, English is used as a medium of instruction for most of the subjects, and students concentrate their studies on aiming to complete their secondary school education with the General Certification of Education (GCE) and General Certification of Secondary Education (GCSE), which is awarded by different examination boards in Britain such as the University of London or the Cambridge University. Students graduating from those schools may plan to further their studies in Britain, USA and Australia.

In those schools adopting the Portuguese educational system, Portuguese is used as a medium of instruction for most of the subjects, and they follow the Portuguese education system, so that graduates will be able to line up their curricula with those in Portugal.

Finally, in those schools adopting international schooling, what takes place depends on the school itself; some international schools are following the Canadian educational system, and they are registered in Canada. Graduates from these schools are more oriented to have their tertiary studies in Canada.

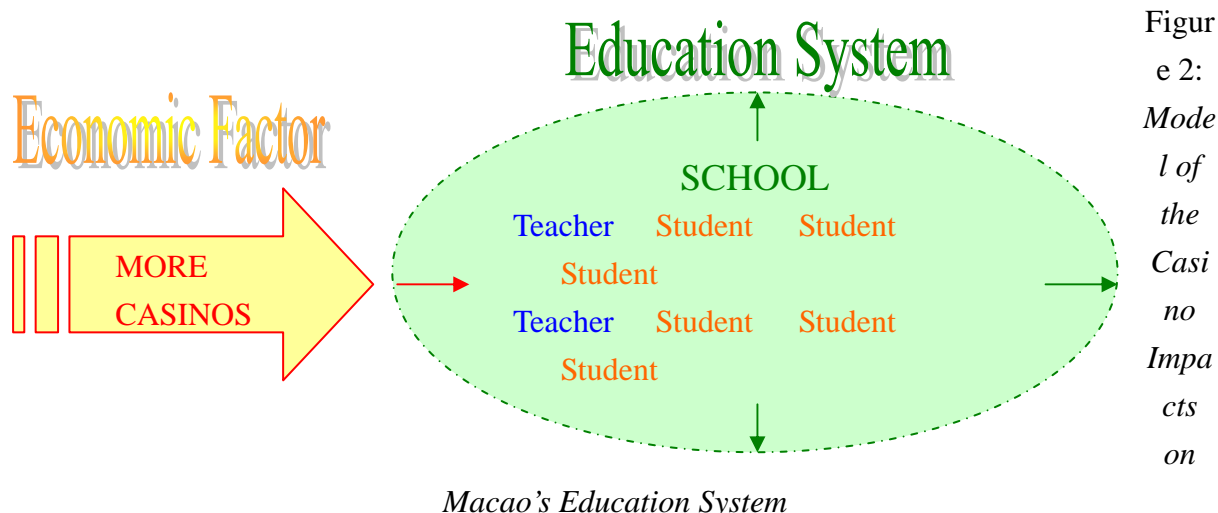
Recently, the Macao government has moved to unify the education system by working on education reform. Macao's Chief Executive, Edmund Ho Hau Wah, listed the 'start-up of the educational reform' as one of the key points of the Macao government's administration in 2005. The Macao SAR government has allocated more funds to education, increased subsidies to ensure 'free education', built and rebuilt school premises, encouraged new forms of teaching, advocated cooperation between parents and schools, and promoted lifelong learning. At present, the number of students (c.100,000) in Macao accounts for just over 20 per cent of its total population of 488,000. Macao's education is characterized in official statements as 'putting people first'. In his Policy Address delivered in November 2005, the Chief Executive said that 'to serve students is the core spirit of the educational reform'.

### **Economic Impacts on Macao's Secondary Schooling**

Macao's Secondary schools have been affected by the economic impact brought about by

the increasing tourism and casino industries. The effects are on three main parties: students, teachers and the school itself (Figure 2). Figure 2 shows that outside economic influences – the rise in tourism and the casino industries – has impacted on the heretofore closed education system.

Within the traditionally closed-system secondary schools, the school, teachers and students are inter-connected. They depend on each other, but as a whole, the system to date has been isolated from many outside factors, such as economic, political and social factors etc.. In this paper, their reactions to changes in external environments in Macao are examined through the lens of complexity theory. Further consideration of the relationship between complexity theory in education and the economic impact is provided later in this paper. Before that, this paper concentrates on explaining three elements within the closed system: students, teachers and school.



**Economic Impact on Students**

Although the birth rate in Macao remains relatively constant at around 7% over recent years, the numbers of students actually remaining in school are dropping (Table 3). The progressive decrease in the number of students is caused by recruitment to the casino industry, and the expected numbers remaining in secondary schooling has reduced, as students leave school to enter the labour market (Table 4). The labour market has become attractive to this target audience aged 14 to 24, and this can be attributed to three reasons. One is that the youth are doing poorly in school and that they would be removed from school anyway, so another opportunity for school dropouts is that – more positively – they choose an alternative to formal education, which is to enter the labour market.

Another reason is that Macao is offering free education for 10 years only, i.e. only up to

the end of junior high school, so, in order to attend senior high school, parents have to pay school tuition fees. Since the employment market pull of the casinos is so strong, together with the fact that the basic income from casino work is high compared to other business work (even teachers leave the profession to work in the casinos), some parents encourage their children to work rather than to study. It is important, therefore, in respect of secondary schooling, that immediate actions be taken to increase the adaptability and competitiveness of poorly educated students, who are lacking working experience and skills.

A third reason is the allure of immediate, relatively highly paid employment in casinos for teenagers and, indeed, their teachers (who can earn more in low-skill casino work than in teaching). Short-term financial recompense, indeed relatively handsome recompense, holds more attraction for some teenagers and so they leave school. The fact that such employment holds out little opportunity for career development appears to be of little concern for such students.

Table 3: *Population in School related to Birth Rate*

	2003	2004	2005
Birth Rate	7.2	7.2	7.7
Students in Regular School	110,266	110,494	108,407
Students in Vocational-technical School	2,448	2,349	2,245

(Data retrieved from the web of Government of Macao SAR, Statistics and Census Service)

Table 4: *Population in Employment and the Labour Market*

	2003	2004	2005
Employment Rate for ages 14 ~ 24	20.5	22.6	26.9
Labour Market Rate for ages 14 ~ 24	23.3	25.3	29.3

(Data retrieved from the web of Government of Macao SAR, Statistics and Census Service)

### ***Economic Impact on Teachers***

Teaching used to be a high prestige career in Macao, considered to be the second best career to working for the government. Although the salary of a teacher may not be as high as working for the government, the holidays and respect from other people made this career very attractive to young graduates. Moreover, the Macao government gave teachers added incentives such as tax exemption, medical coverage, and a subsidy. Recently, with the casinos contributing so much to Macao's economy, changes have occurred. Government jobs become not always the first priority, as the basic entry salary is not competitive to that derived from working in a casino. Therefore, the number of teachers and the rate of recruitment has been declining and fluctuating (Tables 5 and 6). From this actual fact, the



education system has been affected from the outside factor: the economic impact. Since fewer graduates are turning to education careers, and teachers are moving to work for the casinos, a situation is possible that the current secondary schools face significant difficulties in the recruitment and retention of teachers, the quality of teaching and learning, and the related knock-on effects of a decrease and fluctuation in the teaching workforce, as shown in the figures below.

Table 5: *Increasing Rate of Teacher Entering the Education System*

2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
9.1%	7.3%	2.9%	13.4%	3.8%	3.7%

(Data retrieved from the Education and Youth Affairs Bureau of the Macao SAR)

Table 6: *Numbers of Teachers in School*

	2001/2002	2002/2003	2003/2004
Government Schools	381	370	365
Private Schools Providing Free Education	2,933	3,008	3,233
Private Schools Not Providing Free Education	736	699	733
Total	4,050	4,077	4,331

(Data retrieved from the Education and Youth Affairs Bureau of the Macao SAR)

### ***Economic Impact on Schools***

There is a decline in the numbers of students and teachers in school, and the education system is being challenged. Macao's secondary schools are strongly affected by these changes, as the students are quitting at the level of junior high school or immediately on completion of junior high school. Fewer graduates are turning to teaching as a career. Although the Macao government has been putting much effort into the education system, the situation remains problematic. Macao's Chief Executive has commented, in his 2006 policy address, on the education system thus:

#### *Increasing investment in education:*

- Extending free education to kindergarten;
- Subsidizing additional fees collected by private schools and eventually eliminating such fees in 2006/2007 school year.
- Providing a subsidy of 5,000 patacas to each senior secondary student and completing the study of the extension of free education to senior secondary classes, in pursuit of the implementation of the 15 year free education in the 2009/2010 school year.

- These subsidies will increase the Government's budget for education by 50%, to a total of 880 million patacas.

The big investment in schooling may assist the schools, but it remains to be seen how this addresses the key problem of losing teachers and students. Increasing financial input into schools, as complexity theory implies, does not guarantee improvement. Complexity theory suggests that there is no linear relationship between the size of the input and the size of the outcome; the relationship between the two is nonlinear. How can this situation reported above be understood through the lens of complexity theory? This is addressed in the following section.

### **Parental Involvement in Macao's Education System**

Historically, schools in Macao have had a lot of autonomy, controlling themselves. The position of parents has been one of subordination to the schools. Schools in Macao have not felt themselves accountable to parents; rather, the reverse has been the case. The relationships between schools and parents have been minimal. Parents' choice of schools has been based on several factors, for example:

- The school's reputation;
- How much the parents can afford, not least in respect of the cost for the miscellaneous fee from the school (i.e. in addition to any free tuition supported by the government);
- Their children's performance, both academically and behaviorally.

However, in many of Macao's secondary schools (with some notable exceptions), once the children are in the school, the parents have been hardly involved at all, nor have they participated in schools' activities – schools have not involved parents, but have kept them remote and subordinate. At most, parents would only be given the opportunity to go to school to attend parent/teacher meetings once or twice a year and that is all. Since the schools have been closed to the parents, and since the changes to the economic situation in Macao have arisen, it is becoming clear that schools now face many problems, which are inter-related, and connect with human or social or personal problems that children bring from their families.

In 2006 a survey of Parental Involvement in Schools in Macao (Tchiang, n.d.) was conducted, the target participants being teachers in Macao, who were asked to report their perspectives on, and knowledge of, the issue of parental involvement in their schools. Consideration of parents' positive and negative behavior in respect to the students'

performance in schools was included. Moreover, difficulties that schools face with parents and teachers were also indicated. The survey addressed difficulties within the school that might be brought by the parents. A total of 432 questionnaires were filled-in by 45 secondary school teachers in Macao. SPSS data analysis revealed that schools had been encountering problems from home and parents quite vigorously. These problems included the following, set out below. One can observe that many are connected to human frailty and suggest that schools are becoming increasingly subject to outside influence on their hitherto closed system, and that these outside influences are not only from the economic and political factors mentioned earlier, but also, and importantly, from social factors.

The problems that schools encounter that are associated with social and humanitarian factors include:

- (1) Parental pressure and too-high expectations;
- (2) Violence and criminality;
- (3) Parents not facing up to their parenting responsibilities;
- (4) Parents' self indulgence.

**Ad 1.** Parental pressure and expectation were evidenced in their negative behavior with their children, in particular with regard to two problem categories: (1) family behavior; and (2) parents and school. Within these two categories, the actual problems identified by the teachers from the survey were: (a) parents putting too much pressure on their children; (b) parents expecting too much from their children; and (c) parents comparing their children negatively with others.

**Ad 2.** Violence and criminality were reflected in three problem categories: (1) family behavior; (2) student behavior; and (3) family problems. Within these categories, the actual problems identified by the teachers in the survey were: (a) parents scolding children all the time; (b) parents ignoring children misbehavior; (c) parents saying bad words / swearing; (d) family violence; and (e) poor relationships between parents and children.

**Ad 3.** Not facing up to parental responsibility was evidenced in relation to two problem categories: (1) relationships between parents and children and (2) parents and school. Within these categories, the actual problems identified by the teachers from the survey were: (a) parents not communicating with children; (b) parents giving inappropriate instructions to their children; (c) students being left on their own at home.

**Ad 4.** Parents' self indulgence was evidenced in relation to two problem categories: (1)

parents’ behavior and (2) parents and school. Within these categories, the actual problems identified by the teachers from the survey were: (a) parents gambling; (b) parents being too materialistic; (c) parents not communicating with the school sufficiently.

All the above problems were impacting directly on the schools, by means of affecting the students’ performance in school, both academically and behaviorally. When teachers at the schools probed the reasons behind the students’ poor performance or poor behavior they found that, in an increasing number of cases, the problems resided outside school and in the home, and yet the school was often the place in which they were revealed and in which the effects were felt.

From the survey data, principal component analyses with varimax rotation and Kaiser Normalization were conducted on a provided list of variables of problems. The scree test was used to determine the number of factors, and Eigenvalues equal to or greater than 1.00 were extracted. With regard to the variables included in the survey, the scree test and orthogonal rotation of the factors yielded four factors, accounting for 73.67 per cent of the total variance. To enhance the interpretability of the factors, only variables with factor loadings of >0.68 for factor one, >0.66 for factor two, >0.66 for factor three, and >0.60 for factor four were selected for inclusion in their respective factors. Factor one is named *parents’ behavior*, factor two is named *behavior in the family and peers*, factor three is named *student behavior*, and factor four is named *parent’s setting a bad example*. The factor loadings are presented below:

*Factor One: Parents’ behavior (34.9% of total variance)*

**Rotated Component Matrix**

	Component
	1
Parents being rude	.692
Parents being greedy	.748
Parents mocking others	.721
Parents being materialistic	.713
Parents lying to their children	.797
Parents not communicating with children	.746
Parents scolding children all the time	.772
Parents ignoring children's misbehaviour	.764
Parents ignoring children's good behaviour	.775
Parents putting too much pressure on their children	.827
Parents expecting too much from their children	.822
Parents making their children feel unjustifiably guilty	.809
Parents encouraging children to hide the truth about wrong deeds	.776
Parents allowing their children do whatever they want, even though it is not acceptable	.752
Parents not caring about their children's school performance	.722

*Factor Two: Behavior in the Family and Peers (20.2% of total variance)*

**Rotated Component Matrix**

	Component
	2
Students being in gangs	.774
Students being absent from school	.679
Family violence	.826
Parents giving inappropriate instructions to their children	.739
Poor relationships between parents and children	.666
Arguments at home between siblings	.770
Parents involved in crime	.854

*Factor Three: Student behaviour (12.4% of total variance)*

**Rotated Component Matrix**

	Comp
	3
Lying	.677
Saying bad words / swearing	.667
Students having no interest in studying	.723

*Factor Four: Parents Setting a Bad Example (6.1% of total variance)*

**Rotated Component Matrix**

	Comp
	4
Parents smoking	.626
Parents gambling	.605

These social problems that the schools are facing suggest that the schools can no longer ignore the presence of parents, as had been their tradition to date. More and more social, family and domestic problems are coming to schools; schools become the arena in which these are played out, and parents are bringing more and more problems to the attention of schools, yet the schools are ill-equipped to handle these, because they are not used to handling them. The traditional neglect by schools of an important external environment – parents and community – is now backfiring on the schools in the face of changes wrought by economic development in Macao; its secondary schools have little experience of, and little expertise in handling, the social and domestic problems that are increasingly being brought to schools, both by students and their parents.

The message from complexity theory is clear: it is dangerous to be too selective on which environments on which to focus, as non-linear, unexpected change can bring new demands on

schools which, if they unprepared for them, they are unable to handle effectively. The issues are of preparedness and redundancy (Kelly, 1994): there need to be sufficient of both in Macao’s secondary schools so that, when new situations emerge, the schools are sufficiently self-organized and with sufficient redundancy in the system, to enable them to cope with the emergent pressures.

Secondary schools in Macao need to handle the emergent problems by means of opening themselves to the parents, and trying to work on the parents or educate the parents, so that those social problems from parents might reduce. The difficulty is that the secondary schools in Macao are currently in a poor position to provide help or to ease the parents, as they have little or no background in, or heretofore, connection with, the parents. The idea of many of Macao’s secondary school to date is not to involve parents, but now this is repeating a bitter harvest in that, as more social and domestic problems arise, the schools, because they have been remote from parents, may not be able to meet the new demands placed on them, and hence their situation might worsen. The situation in which it is encountering the problems brought by the parents can be shown in Figure 2.

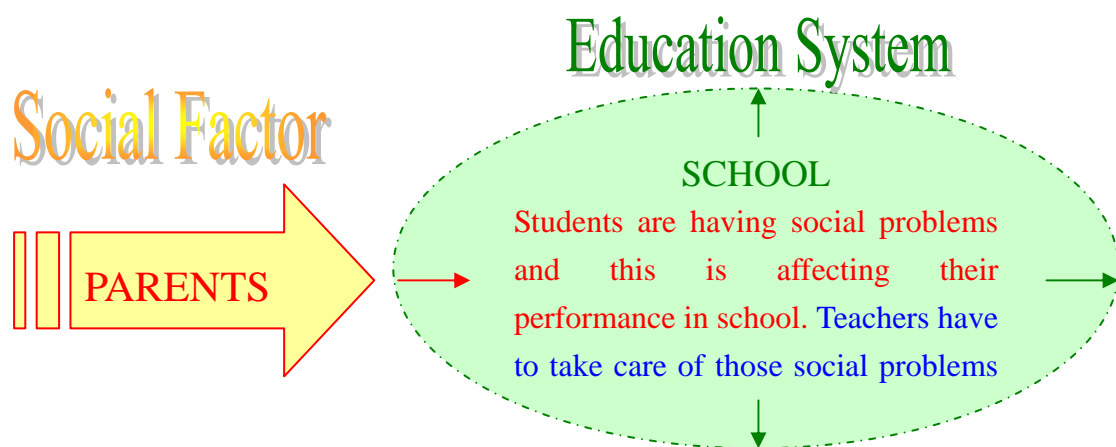


Figure 2: Model of the Parental

*Impacts on Macao’s Education System*

**Complexity Theory in relation to Macao’s Secondary Schools**

Complexity theory is a theory of change, evolution, adaptation and development for survival (Morrison, 2002); it suggests an alternative approach to looking at phenomena and situation. In the context here, complexity theory suggests that the secondary schools in Macao have to evolve and change in order to meet changing demands and external environments, and this means opening themselves to parents.

One central characteristic of complexity theory is self-organization, it is the ability for a system to evolve itself from within; the nature of emerging self-organization is that it is a

‘bottom-up’ process (Marion, 1999). In order to have self-organization, further adaptability, open-systems, learning, feedback, connectedness and emergence for the system are necessary. All these features can be found in the Macao secondary schooling system, as discussed below.

Many secondary schools in Macao until now have been closed systems in which they did not want to open themselves to the outside world. For example, only a few of the schools (less than 20 out of 45, some 44%) have a web site that allows visitors to see what is taking place, and among these web sites, less than 10 out of 20, some 22% of the total numbers of high schools, are actually informative; often they are only open to their own students and teachers, and are not open to the public. Moreover, the schools are technically only responsible to disclose their information to the Education and Youth Affairs Bureau (Direcção dos Servicos de Educação e Juventude) (DSEJ) of the Macao SAR, but not to others. Secondary schools in Macao have tended not to expose themselves to many outside factors, and this continues to date in several of them.

The main concern for the school is only to have good numbers of students so that they would be able to apply for the subsidy from the government. So the only outside force that may be of the school concern would be from political factors. In addition, since the education system does not have a single common curriculum to follow, schools in Macau have *evolved* themselves to fit what they see as appropriate for the market. Schools are aware of their own characteristics and core properties, they understand the importance of self-regenerating and self-perpetuating. They are aware of their connection with the society or the market (Wheatley, 1999). However, the economic changes brought about by the rise in gaming and casino industry, have had significant social and domestic consequences; schools are having to *open* themselves to the economic environment and, importantly, its consequences much more fully. Complexity theory suggests that stable systems do not succeed, and that closed systems in stable equilibrium gradually die (Stacey, 1992); if secondary schools in Macau do not open themselves to parental involvement then their future may be in jeopardy.

Although Macao’s secondary schools may be making considerable efforts to *adapt* through opening themselves to the outside world, including the economic environment, one problem in Macao is that they have suddenly been propelled into taking account of the economic changes and its consequences, and, since they have traditionally neglected other kinds of environment, for example parental involvement, they are experiencing difficulties in handling the situation.

Complexity theory suggests that the organism (the school) has relations with, is connected to, and has networks that involve, several kinds of environment. However, currently Macao's secondary schools are becoming affected not only by the political and economic environments, but by the consequences of these, e.g. moral, social, cultural. Hence secondary schools in Macao are having to work on *emerging* themselves (self-organization) to economic and political imperatives and, importantly, their consequences. Whilst the secondary schools have had offered some connection to the worlds (environments) of employment through their curricula, this is now proving itself to be insufficient, as more environments are pressing their demands on the schools. The realization that teachers and students are leaving school to work in casinos is forcing them to reconsider their role in the overall society of Macao, not simply as providing employees. There are emergent driving forces for adaptive, dynamical processes that lie in the external environment, and schools have to be equipped to handle these (Waldrop, 1992; Kauffman, 1995). Macao's secondary schools to date have not been sufficiently oriented to parents, but the impetus to change is powerful, given the changing economic and political fortunes of Macao.

### **Conclusion**

Complexity theory supports the idea and practice of schools being open systems, such that feedback from the outside world alters the schools, particularly when problems arise that are associated with:

- (a) economic factors: the development of the casino industry, causing students and teachers to leave school;
- (b) political factors: the government policies of subsidies that lead the schools to endeavor to keep students in classrooms;
- (c) increasingly, to social factors: parent-oriented problems and their effects on students, that the schools have to face.

The environments reported in this paper in which schools operate are not only political and economic, but also include social, cultural, domestic, familial and moral. And it is these latter environments that appear to be being poorly addressed in current secondary schooling in Macao, as schools are necessarily having to both respond to, and be proactive in relation to, their external environments. Schools, being part of Macao's development, have to open themselves to a range of external environments, not solely economic and political. Currently, this paper has suggested that they are being too driven by economic imperatives, and to the detriment of social, moral and cultural environments, this can be explained from the model below representing only part of the organization are opening to the specific areas but rather to all of the environments (Figure 3).



The situation is becoming highly problematic in Macao; students are leaving schools too early, teachers are moving out of schools, and schools are closing or are shrinking. Many schools in Macao do not have strong enough links with parents, and yet many parents are bringing more and more problems to the schools for them to solve, and these problems are often associated with the effects of increased gaming and poor career prospects in Macao. There is an urgent need for considerable professional development of teachers to be able to handle such emergent issues. There is an urgent need not only for more school counselors, but more expertly and experienced school counselors to work with parents and students. There is an urgent need for far more experienced social workers to work with parents, families and students who are encountering difficulties that impact on the schools. Many of Macao's secondary schools have few, if any, appropriate resources, in themselves, on which to draw to handle students' and parents' social, personal and familial matters (Suárez Díaz and Morrison, 2005). They currently have nothing to fall back on; there is no redundancy in the system.

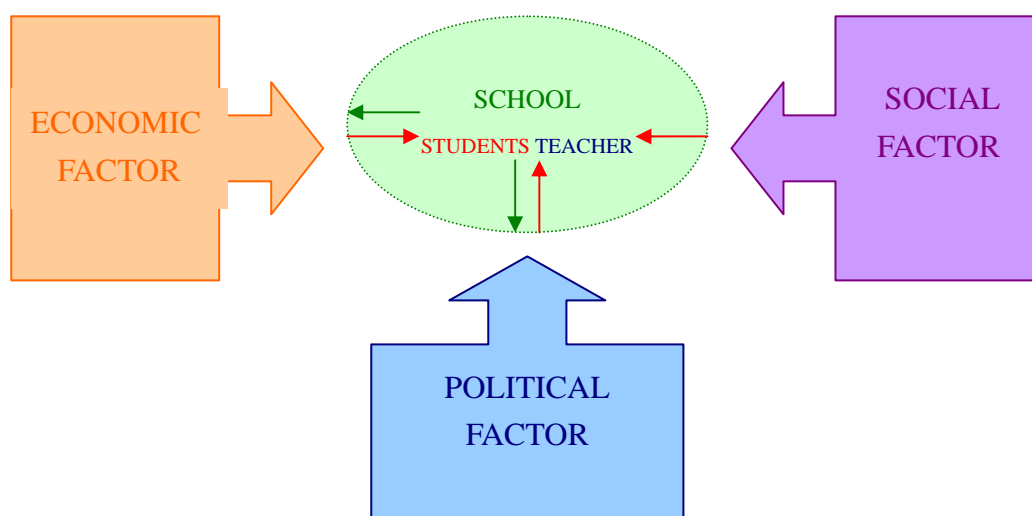


Figure 3: *Relationships between schools and outside environments*

A complexity theory perspective suggests that Macao's secondary schools should become more open systems, and that they should be open to a *range* of environments, not simply economic or political. The schools should be self-organizing themselves to face this significant matter, or risk their own demise. With regard to emergence, Macao's secondary schools are considering a range of environments to which to respond; indeed they should be taking the lead – being proactive – in handling the changing economic climate and its effects. The networking between the schools, their communities and society (e.g. the economic

aspects, the political aspects, and the social aspect) are too strong for the schools to continue to shut their doors and ignore the outside world.

Secondary schools in Macao, by dint of their traditional closure to parents, are in a poor situation in regard to connectivity with parents, and yet it is imperative that they open themselves up more to parents as more and more family and relationship matters are presenting themselves to schools by both the parents and the students. Schools should be advising the government more that social problems are arising. A corollary of all of this is that there needs to be urgent and extended focus placed by the schools and the Macao government on parental involvement in schools. Schools need to attend to a range of environments, not simply, or mainly, economic or political.

This raises an important issue for complexity theory. Complexity theory is an amoral theory; arising from the natural sciences it is, perhaps necessarily, silent on morals. However, the case study here is arguing that education is a moral activity, and that complexity theory can operate in this sphere. This raises the question of whether this commits a category mistake – mixing morals and their necessary absence. How can, and should, schooling, which is a moral activity, be informed by an amoral theory? Is it appropriate to use complexity theory in provinces to which it does not naturally belong?

Finally, the question is raised of whether the case study here reveals the limits of complexity theory – whether complexity theory is so highly general and platitudinous (perhaps only a metaphorical nicety) that it adds rather little to the analysis. Does one really need complexity theory to assist in the understanding of the phenomenon under study here? If the answer is ‘no’ then this could, of course, be because the phenomenon itself is not suitable for a complexity theoretical analysis, i.e. it is trying to analyze a situation with the wrong tools. On the other hand it could be because complexity theory has limited power or utility. Which of these it might be, is, perhaps, an open question.

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