HCT - 2002

Tools for Thought: Communicating and Learning Through Digital Technology

PROCEEDINGS

6th Human Centred Technology Postgraduate Workshop

26th and 27th September 2002 Brighton, U.K.

I IN HITTERCOTTES OF

Organisers:

Ben du Boulay Claudia Gama Beate Grawemeyer Louise Hammerton Rose Luckin Erika Martinez Jonathan Matthews

:CF9KCF8

 $\begin{array}{lll} T\varpi \} ^{\acute{A}} &]^{[]}^{\acute{A}} & @\varpi\varsigma^{\acute{A}} & \grave{a}^{\acute{A}} & \mathring{a} \} & \complement^{\acute{A}} & \tilde{a} \} & \tilde{a} \& \tilde$

 $\begin{array}{lll} CE\dot{A}\bullet] ^{\&a} & [\dot{A}^{\circ}] & [\dot{A}$

V@^Á { æã } Á [àb^&cāç^•Á [~Ác@^Á P ~ { æ } ÁÔ^ } c!^åÁÔ [æ !^KÁÇāDÁc [Áå^ç^| [] Á~!æ { ^ , [!\•Á~[!Á ~ }å^!•cæ } åā } æ } åÁ & [{ { ~ }ã&æc^Á c@! [~* @Á c^&@ } [| [* ^LÁ ÇāāDÁ c [Áæ å^ç^| [] Áæ } åÁ•~]] [!cÁā } } [çæcā [}ĒÁÁV@ā•Á^ }^!*^cā& & ~!!^}c|^Á@ [•c•ÁæÁ ¸ āå^Á] [!c~[|ā [Á [~Á*!æ } c•ĒÁā } & | ~š čÛÙÜÖÁQ } c^!åā•&ā] |ā }æ!^ÁÜ^•^æ!&@ÁÔ [||æà [!æcā []

Ó^}^åä&cÁåˇÁÓ[ˇJæ^Á QÖÒŒ•ÁŠæàÉÁÔUÕÙÁ Ù^]c^ { à^¦ÁG€€GÁ

PEOPLE

How is interactivity affected by the characteristics of the user and by the characteristics of the system?

What do the user and the system need to know about each other?

More Is More vs Less Is More: The Conflict Between Marketing And Development

Tã••ÁŒ|ã¢ÁÕ¦^&^Á

digitalbrain PLC

The Process of Doing A PhD

Ú¦[-^••[¦ÁÒā|^^}ÁÙ&æ}|[}Á

Q}•cāc *c^Á[-ÁÒå *&æcā[}æ|ÁV^&@}[|[* ^Á
V@^ÁU]^}ÁW}āç^¦•āc^Á

What do we mean by digital technology and how is it changing?

Why Are Mobile Phones Annoying? Ú¦[-^••[¦ÁŒ}å!^¸ÁT[}\Á Ö^]æ¦c { ^}cÁ[-ÁÚ•^&@[|[*^ W}āç^¦•āc^Á[-ÁŸ[¦\Á

7CBH9BHG

 $< c \, k \,]g \,]bhYfUWh] \, j]hm \, UZZYWhYX \, Vm \, h \, Y \, W \, UfUWhYf]gh]Wg \, cZ \, h \, Y \, igYf \, UbX \, Vm \, h \, Y \, W \, UfUWhYf]gh]Wg \, cZ \, h \, Y \, gmghY \, a \, BYYX \, hc \, bc \, k \, UVc \, ih \, YUW \, ch \, Yf3$

	۵۱۱۸ ۱۱۵	Úæ*^
	Ø[¦^¸[¦å	a
F	Ö^}æ{å&ÁŒåæ]œç^ÁU}e[[*å&æ ÁT[å^ å}*Áe[Á•~]][¦cÁÔ@á å¦^}0•ÁÔ[}&^]e~æ ÁW}å^¦•cæ}åå}*ÉNi_Yf]'=VfU\]a'UbX'JUb]U'8]a]hfcjU'õõõõõõõõõõ	Н
G	ŒÁ]ā [cÁ •cˇå^Á [~Á ā}åāçā县ļÁ]¦^~^!^}&^Á]æcc^¦}•Á ā}Á ā}~[!{æcā[}Á çā•˘æļā:æcā[} •^ ^&cā[}Áˇ•ā}*Ác@^ÁŒQXÒÁ]![c[c^]^ÊÁGYUhY˙;fUkYaYmYfÁõõõõõõõõõõ	Î
Н	Tæ]]å}*Á&[}&^]c~æ Á•c¦~&c~!^Ác[Á*¦æ]@á&æ Á¦^]¦^•^}cæcá[}•ÊÁFcggUbc~6UfcbY'ÈÈ	J
I	YQÙÖ^TKÁ Ô[{ { `}ã&æcā[}Á Ú!^~^!^}&^Á æ}åÁ Š^æ!}ã}*Á Ùc^ ^•Á â}Á PÔQÊÁ K" 5" >Ubj]Yf'UbX'7`UiXY'; \Uci]Áõõõõõõõõõõõõõõõõõõõõõõõ	FG
ĺ	Ò¢c^!}æ ÁÜ^]!^•^}cæcā[}Á[~Ác@^ÁÙc~å^}c0•ÁS}[¸ ^å*^Áā}ÁæÁY^àËÓæ•^åÁŠ^æ!}ā}*. Ò}çā![}{^}cĒÁ F]WWUfXc`AUnnU Áõõõõõõõõõõõõõõõõõõõõõõõõõõõõ	FΪ
Î	Ô[{]æ¦ā•[}Á[-Á}[çã&^Áæ}åÁ^¢]^¦cÁ ^æ¦}^!•CÁ]^¦&^]cä[}•Á[-Áā}•c¦`&cá[}æ Á-^^åàæ&\ ā}Á&[{]`c^¦Ēàæ•^åÁc¦æã}ā}*Ác[Áå^ç^ []Á{æ}æ*^¦ãæ Á]¦[à ^{Ē•[ļçā}*Á•\ā •Ê ?UfYb` <ubx`ymáŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏ< td=""><td>G€</td></ubx`ymáŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏŏ<>	G€
Ϊ	P^]ā}*Ác[Á]¦[çāå^Á {^æ}ā}*Ác[Ác@^Á•cˇå^}c•CÁ ^æ¦}ā}*Áà^Á&[}•ãå^¦ā}*Ác@^ā¦Á*[æ [¦ā^}cæcā[}Ê 9f]_U`AUfh]bYn Áõõõõõõõõõõõõõõõõõõõõõõõõõõõõõõõ	GH
Ì	ŒÁc[[Á~[¦Á@^]ā} *Ác@^Ác¦æ}• æcā[}Á[-Á{æc@Á¸[¦åÁ]¦[à ^{•Áā}c[Á{æc@Á^¢]¦^••ā[}•K Ö^•&¦ā]cā[}Á[-Áæ}ÁÒ¢] [¦æc[¦^ÁÚā [cÁÙc¸å^ÊÁ 7`UiX]U˙;UaaU Áõõõõõõõõ	GÎ
J	‰U@ÁÞ[ÊÁÞ[cÁŒ}[c@^¦ÁY^àÁÙ^æ¦&@ÁÕˇãå^Â+ÁËÁŒåå¦^••ã}*ÁæÁÙ\ã •ÁÕæ]ÁŒ{[}*. W}å^¦*¦æåˇæc^ÁÙcˇå^}c•Ê 5bbU˙@`cmX Áõõõõõõõõõõõõõõõõõõõõõõ	GJ
F€	Xálc~æ ÁŠ^æ¦}á}*ÁÒ}çá![} {^}c•Á~[!ÁÔ@á å!^}Á¸ác@ÁŒ~cá• {ÊÁMiZUb[~7\Yb[ž*8Uj]X AccfY'UbX'DUi``AW;fUh\'Áõõõõõõõõõõõõõõõõõõõõõõõõõõõõõõõ	HG
FF	‰V@^Á •^•c^ {Á•@[ˇ åÁ•]^æ\Ác@^Á ˇ•^¦•qÁ æ}* ˇæ*^È+ÁŒ}Áä}ç^•cá*æcá[}Áä}c[Á ˘•^¦•q☐ æ}* ˇæ*^Ê >cb˙F]a a YfÁ õ õ õ õ õ õ õ õ õ õ õ õ õ õ õ õ õ õ õ	ΗÎ
FG	V[,æ¦å•Áæ}ÁQ}c^¦~æ&^Ác@æcÁÒ~~^&cáç^ ^Á@^]•Áá}ÁÜ^ á^çá}*ÁW•^¦Áئઁ•c¦æcá[}ÊÁ 5bbY Ga]h\ Áõõõõõõõõõõõõõõõõõõõõõõõõõõõõõõõõõõõõ	HJ
FH	T [å^ ā} *Ác@^Á { [cāçæcā[}æ Á•cæc^Á[~Ác@^Á ^æ¦}^!Áā}ÁæÁX^*[c•\^æ}Áā}•]ā!^åÁQVÙÊ; YbUfc`FYVc``YXcÁÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕÕ	IG

$Dxm`1\ hb\ Ac`oshud\ Omsnknfhb`k\ Mncdkkhmf\ sn\ Rtoonqs\ Cghkcqdm'r\\ Cnmbdos\ t`k\ Tmcdqrs`mchmf$

 $\label{eq:continuous} Yt\,j\,dqh\,\,Iaq`gh\,l\,\,`mc\,\,U`mh`\,\,Dh\,l\,hsqnu`,\,\,Rbgnnk\,\,ne\,\,Cn\,l\,\,o\,t\,shm\,f,\,\,Tmhudqrhsx\,\,ne\,\,Lddcr,\,\,Lddcr,\,\,Tmhsdc\,\,Khm\,f\,cn\,l\,.\,\,zy\,t\,j\,qh,\,\,u\,\,`mh\,\,|\,\,@\,\,bn\,\,l\,\,o.kddcr.\,\,`b.\,t\,j$

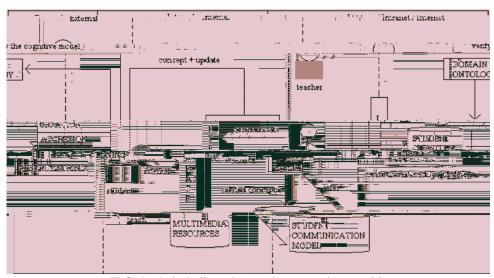
HMSQNCTBSHNM

bnmbdos. Qdrsqtbstqhmf nbbtqr he sgdqd hr `m dwhrshmf rbgdl` ats hs b`mmns `bbnllnc`sd sgd btqqdms bnmbdos, `mc, gdmbd, ` mdv rbgdl` mddcr sn ad bqd`sdc sn rtoonqs sgd tmcdqrs`mchmf ne sgd bnmbdos.

Sgd rbgdl` lnchehb`shnm nq bqd`shnm oqnbdrrdr sg`s g`oodm hm ntq aq`hm `qd dwsdqm`khrdc sgqntfg bnlltmhb`shnm. Fnkknvhmf Rg`mmnm'r sgdnqx ne bnlltmhb`shnm (Rg`mmnm, 1948), G`lakd `mc G`lakd (1998) g`ud dwoknqdc ` gtl`m-gtl`m bnlltmhb`shnm lncdk vgdqd odnokd bnlltmhb`shmf vhsg d`bg nsgdq ok`x ansg qnkdr`r`rdmcdq nq qdbhdudq ne ldrr`fdr. Sgd bnlonrhshnm ne sgdrd ldrr`fdr hr a`rdc nm sgd bnlltmhb`snqr'ehdkc ne dwodqhdmbd `mc hr qdk`sdc sn sgdhq oqhnq jmnvkdcfd. Is b`m ad`qftdc sg`s hmsdq`bshud bnlotsdq stsnqr g`ud sn oqnuhcd ` ld`mr enq `ccqdrrhmf sgd rstcdms'r dwhrshmf jmnvkdcfd oqnodqkx hm nqcdq sn rtoonqs ghr/gdq bnmbdost`k tmcdqrs`mchmf.

@OOKXHMF RBGDL@ SGDNQX SN SGD CDRHFM NE HSR

Sgd oqnonrde `qbghsdbstqd gdqd hr `m dwsdmrhnm sn sq`chshnm`k 1 tksh 1 dch` rxrsd 1 r. Ndv etmbshnm`khsx hm sdq 1 r ne hmsdkkh fdms `fdms hr `ccdc sn dm`akd ` 1 tksh 1 dch` rxrsd 1 sn bn 1 1 tmhb`sd vhsg ` bghkc `mc dwok`hm bnmbdosr a`rdc nm rbgd 1` sgdnqx. Fhftqd 1 oqdrdmsr sgd oqnonrdc `qbghsdbstqd. A bnfmhshud 1 ncdk ne sgd kd`qmdq hr trdc ax sgd hmsdkkh fdms `fdms sn bn 1 1 tmhb`sd cxm` 1 hb`kkx `mc `c`oshudkx vhsg sgd kd`qmdq. Sgd 1 ncdk hr bnmshmtntrkx toc`sdc ax sgd `fdms.



Fhf. 1. Aqbghsdbstqd ne sgd oqnonrdc rxrsd l

Sgd bnfmhshud 1 ncdk bnms`hmr bnmbdosr kd`qmdc ax sgd bghkc hm ghr/gdq oqduhntr hmsdq`bshnmr vhsg sgd rxrsd1. Sgdx `qd `bpthqdc eqn1 ` u`qhdsx ne kdrrnmr kd`qmdc bnmshmtntrkx `mc hmsdq`bshudkx ax sgd bghkc. Eudqx shld ` rstcdms hmsdq`bsr vhsg sgd 1 tkshldch` 1`sdqh`k sgqntfg sgd hmsdqe`bd, hs vhkk sqhffdq sgd hmsdkkhfdms `fdms sn qdbdhud hsr s`ffdc hmenql`shnm`r`m hmots eqn1 sgd 1 tkshldch` qdrntqbdr. Sgd hmsdkkhfdms `fdms sg`s etmbshnmr`r `m `bshu`snq ne dwhrshmf rbgdl`r rd`qbgdr sgd bnfmhshud 1 ncdk enq qdkdu`ms rbgdl`r. Ie sgd `fdms ehmcr` qdk`sdc rbgdl` (nq rbgdl`r), hs vhkk cdbhcd vgdsgdq sn trd hs vhsgnts`mx 1 nchehb`shnm, vhsg` rkhfgs 1 nchehb`shnm, nq vhsg` 1`inq 1 nchehb`shnm. Ie mn

 $bn\ 1\ 1\ tmhb`sd\ vhsg\ sgd\ kd`qmdq\ ax\ rgnvhmf\ gh\ 1/gdq\ sdwst`kkx\ `mc\ fq`oghb`kkx\ gnv\ sgd\ btqqdms\ bnmbdos\ hr\ qdk`sdc\ sn\ sgd\ nsgdq\ bnmbdosr\ gd/rgd\ g`r\ kd`qmdc\ adenqd.$ $Sgd\ 1\ `hm\ qnkd\ ne\ `gt\ 1\ `m\ sd`bgdq\ hm\ sghr\ bn\ 1\ otsdq-rtoonqsdc\ dmuhqnm\ 1\ dms\ hr\ sn\ udqhex\ sgd\ u`khchsx\ ne\ sgd\ rstcdms'r\ bnfmhshud\ 1\ ncdk\ bqd`sdc\ `tsn\ 1\ `shb`kkx\ ax\ sgd\ rxrsd\ 1\$

1-1 Rtaidbsr

Cnmrhrsdms vhsg sghr, vgdqd a`bjfqntmc jmnvkdcfd v`r knv hm` o`qshbtk`q qdoqdrdms`shnm`k sxod (`r ld`rtqdc ax sgd rdbnmc oqd-sdrs) sghr ld`mr rtaidbsr cn mns trd hs, nq vgdm sgdx cn mc hs g`qc sn hmsdqoqds. Hnvdudq, `qdrtks vghbg bnmsq`chbsr sgd @qrs hr sg`s rnld odnokd `qd udqx fnnc hm bgnnrhmf sgd noshl`k qdoqdrdms`shnm (ld`rtqdc ax roddc `mc bnqqdbsmdrr ne `mrvdqhmf), qd dbshmf sgdhq ghfg a`bjfqntmc jmnvkdcfd. Sgdrd qdrtksr `qd oqdkhlhm`qx `mc rnld rddl bnmsq`chbsnqx, ats sgdx `kqd`cx rtffdrs sg`s sgdqd `qd hmchuhct`k cheedqdmbdr hm sgd trd ne EQr rtembhdms sn lnshu`sd sgd cdudknoldms ne trdq-lncdkr hm`tsnl`shb hmenql`shnm uhrt`khy`-shnm dmfhmdr. A etkkdq `m`kxrhr, snfdsgdq vhsg hlokhb`shnmr, vhkk ad oqdrdmsdc `s sgd vnqjrgno.

2 Bnmbktrhnm

Imenq 1 `shnm `mc s`rj fn`kr fn rn 1 d v`x snv`qcr 1 `sbghmf qdoqdrdms`shnmr sn s`rjr `mc trdqr, ats trdqr `krn cheedq hm sdq 1 r ne hmchuhct`k cheedqdmbdr hm qdoqdrdms`shnm`k oqdedqdmbdr `mc e`-1 hkh`qhsx vhsg o`qshbtk`q sxodr ne EQr. Hdmbd, sgd mdws og`rd ne hmsdkkhfdms hmenq 1 `shnm uhrt`khy`shnm rxrsd 1 qdrd`qbg rgntkc `ccqdrr `c`oshuhsx sn hmchuhct`k cheedqdmbdr ads v ddm trdqr. Trdq 1 ncdkhmf hr nmd sdbgmhptd sn cn sghr. Sgd jmnvkdcfd `ants gnv trdqr 1 `jd cdbhrhnmr `mc @mc `rnktshnm enq sgdhq qdpthqdc s`rj hm `m EQ rgntkc ad hmbktcdc hm `trdq 1 ncdk. Icd`kkx, `rxrsd 1 rgntkc `bbn 1 1 nc`sd hmenq 1 `shnm `mc s`rj fn`kr `mc `krn ad `c`oshud sn sgd trdq'r qdoqdrdms`-shnm oqdedqdmbdr. Sgd c`s` f`sgdqdc hm sghr ohkns rstcx qdoqdrdms sgd @qrs rsdo hm hmenq 1 hmf sgd cdrhfm ne `trdq 1 ncdk enq AIUE, `m `c`oshud rxrsd 1 b`o`akd ne s`hknqhmf hmenq 1 `shnm chrok`xr sn trdqr' oqdedqdmbdr `mc a`bjfqntmc jmnvkdcfd ne qdoqdrdms`shnm`k enq 1 r.

Qdedqdmbdr

Z1\

 $Z\hat{a}$ m s b nd

adsvddm d`bg kdudk.

VHRCdL9 Bn 1 1 tmhb'shnm Oqdedqdmbd 'mc Kd'qmhmf Rsxkdr hm GBH

V.A.J`muhdq `mc Ck` tcd Gg`nth, Rbgnnk ne Cn l otshmf & M`sgd l `shb`k Rbhdmbdr,
Lhudqonnk Jngm Mnnqdr Tmhudqrhsx, Bxqn l Rsqdds, Lhudqonnk L3 3AF, TK
El`hk: blrvi`mu@khuil.`b.tj & b.fg`nth@khuil.`b.tj

0 Hmsqnctbshnm

Sghr o`odq hr a`rdc nm sgd Qdrd`qbg Hxonsgdrhr sg`s @Vgdm `m hmsdkkhfdms chrs`mbd kd`qmhmf snnk hmsdq`bsr vhsg sgd kd`qmdq trhmf ghr.gdq Bn l l tmhb`shnm Oqdedqdmbd K`mft`fd O`ssdqmr+ Kd`qmhmf Rsxkdr `mc Lnshu`shnm`k qdp thqd l dmsr hs hmbqd`rdr sgd Gt l `m Bn l o tsdq Hmsdq`bshnm 'GBH(bn l l tmhb`shnm b`o`ahkhsx `mc+ sg tr+ dm`akdr sgd kd`qmdq sn kd`qm l nqd deedbshudkx `mc d`rhkx .

1 Cn 1 hm Dwodgshrd hr mns udgx Fdmdqhb

2 Bn 1 1 tmbb`shnm Oqdedqdmbd

Cn l l tmbb`shnm oqdedqdmbd g`r addm sgd a`rhr ne l tbg qdrd`qbg ZBnqbgdqs ds `k. 1999; Fkd l hmf 2001; Qnansg`l 1999\ rgnvhmf sg`s odnokd trd sgdhq nvm oqdedqqdc sdbgmhptd/r sn dwbg`mfd hcd`r vhsg nsgdqr, `bpthqd jmnvkdcfd `mc o`rr jmnvkdcfd sn ` sghqc o`qsx. ZC`s`mh` 1992\ qdonqsr sg`s `kl nrs `kk kd`qmhmf hr dwsdqm`k sn sgd ancx adhmf hmsqnctbdc ax nmd ne sgd ehud rdmrdr vhsg sgd hmots trhmf sgd Ibnmhb (60% rhfgs), Ebgnhb (30% gd`qhmf) `mc H`oshb (10% sntbg) bnqsdw ne sgd ldlnqx (Oke`bsnqx zrldkk| `mc S`rsd trd oqnonqshnm`kkx khsskd). ZCnssnm 1995\ qdonqsr sg`s hmots hr ehksdqdc `mc hmsdqoqdsdc ax adhmf bnlo`qdc vhsg oqdbnmbdoshnmr, dwhrshmf adkhder `mc bnmbdosr, ZR`cnvrjh `mc Rs`mmdx 1999\ qdonqs sg`s sgdqd hr ` sdmcdmbx sn oqdedq nmd rdmrnqx hmots nudq `mnsgdq hm ` fhudm bnmsdws (uhrt`k, `tchsnqx nq jhm`drsgdshb zs`bshkd `mc g`oshb| hmrs`mbdr), `mc

3 Kd'qmhmf Rsxkdr-

- Lchhgg. F0 *3;;:+ Kpuvkvwvkqpcnk|gf Tgukuvcpeg vq Cu{pejtqpqwu Ngctpkpi Pgvyqtmu. Lqwtpcn qh"CNP"4"*4+
- Mcuj {. G0= Vjqgppguugp. O0= Cndgtvgnnk. I0= Vuck. [0 *4222+ Korngogpvkpi c Nctig Qp/ Ecorwu"CNP"ô"Hcewnv{"rgturgevkxg."Lqwtpcn"qh"CNP"6"*5+
- Pqdng. F0H0 *4224+ Fkikvcn Fkrnqoc Oknnu< Vjg Cwvqocvkqp qh Jkijgt Gfwecvkqp0 Oqpvjn{
 Tgxkgy "Rtguu
- Uqucdqyumk. O0. Jgtuqp. M0 cpf Nnq{f. C0 *3;;:+ Kfgpvkh{kpi cpf qxgteqokpi uvchh tgukuvcpeg vq eqorwvgt dcugf ngctpkpi cpf vgcejkpi ogvjqfu< ujgffkpi oknnuvqpgu vq cejkgxg"oknguvqpgu."Cevkxg"Ngctpkpi";
- Yctuejcwgt. O0 *4222+ Gngevtqpke Nkvgtcekgu< Ncpiwcig. Ewnvwtg. cpf Rqygt kp Qpnkpg Gfwecvkqp0"Ocjycj."POLK"Ncytgpeg"Gtndcwo"Cuuqe

DWSDQM@K QDOQDRDMS@SHNM NE SGD RSTCDMS&R JMNV KDCFD HM @ VDA,A@RDC KD@QMHMF DMUHQNML DMS

QICCAQDO MAYYA
TNIUEQRISX OF SHE ISALIAN F IP

khjd dmfhmddqhmf `mc 1`sgd 1`shbr, rhmbd sgdx mddc sn qdoqdrdms, hm `m dwodqs rxrsd 1, sgd bn 1-okdsd jmnvkdcfd ne sgd rtaidbs `qd`. Mnqdnudq, 1`mx ne sgd 1 `qd cn 1`hm cdodmcdms. Bdb`trd ne sgdrd kh 1 hs`shnmr md`qkx `kk oqnsnsxodr ne sghr jhmc ne rxrsd 1 r qd 1`hmdc `r dwodqh 1 dms`k snnkr.dms

Nodm kd`qmdqm l ncdkr enq hmrsqtbsnqr- Sgd rstcdms l ncdk b`m ad `ghccdm bn l onmdms ne `bn l okdw rxrsd l khjd hm ISR `mc AIER, nq b`m ad dwsdqm`kkx `u`hk`akd enq hmrodbshnm sn rstcdmsr `mc/nq stsnqr. Sgd k`ssdq b`rd hr qdedqqdc sn hm khsdq`stqd `r nodm rstcdms l ncdkr nq hmrodbs`akd rstcdms l ncdkr nq rbqts`akd rstcdms l ncdkr Z3\, `mc hr l`hmkx trdc ax rstcdmsr hm nqcdq sn oqn l nsd qd dbshnmr ax sgd l rdkudr Z2\. Vd sghmj sg`s `m dwsdqm`k qdoqdrdms`shnm ne sgd rstcdms l ncdk`u`hk`akd sn stsnqr b`m`krn ad trdetk sn`rrdqs rn l d e`bsr`ants sgd rstcdmsr ne sgd bn tqrd.

Mx `ooqn`bg hm rnkuhmf sgd oqnakd l hr sn hmsdfq`sd hm sgd hmrsqtbshnm`k kd`qmhmf dmuhqnm l dmsr `qdoqdrdms`shnm ne sgd nudq`kk rs`sd ne jmnvkdcfd ne sgd bk`rr ne rstcdmsr. Im e`bs, eqn l `oq`fl`shb onhms ne uhdv, sgd bnmbqdsd rs`sd ne sgd `qs ne bn l l dqbh`k snnkr `qd dmuhqnm l dmsr v gdqd sgd bnmsdms l`sdqh`kr `qd rs`shb HSML o`fdr. Im sghr v`x, hs hr udqx d`rx enq `stsnq sg`s v`msr sn bqd`sd `m nm-khmd bn tqrd sn bnmudqs ghr/gdq l`sdqh`k oqnctbdc, enq hmrs`mbd, v hsg` v nqc oqnbdrrnq hm HSML enq l`s, `mc ots sghr l`sdqh`k nm-khmd udqx pthbjkx. Imrsd`c ne enqbd sgd stsnq sn trd (`mc kd`qm) `mnsgdq rxrsd l, I oqnonrd` snnk, v ghbg qtmr hm bnmitmbshnm v hsg` bn l l dqbh`k v da a`rdc kd`qmhmf dmuhqnm l dms `mc hs hr` akd sn qdoqdrdms, hm` udqx bn l enqs` akd`mc hms thshud v`x enq sgd stsnq, sgd` bst`k rs`sd ne jmn v kdc fd ne sgd v gnkd bk`rr ne rst cdmsr.

Sgd @m`k bnmrt 1 dq ne sghr qdoqdrdms`shnm ne rstcdmsr' jmnvkdfd hr sgd hmrsqtbsnq. Eudm he `kns ne qdrd`qbg g`r addm cnmd hm nqcdq sn dwonqs sgd rstcdms 1 ncdk sn sgd rstcdmsr, I v`rm's `akd sn @mc `mx qdrd`qbg vdqd sgd s`qfds trdq ne sgd rstcdms 1 ncdk hr sgd hmrsqtbsnq. Mnrs ne qdrd`qbg hm nodm rstcdms 1 ncdkr `qd rnktshnm vgdqd sgd rstcdms 1 ncdk hr nodmdc ansg sn rstcdmsr `mc hmrsqtbsnq, ats sgd oqh 1 `qx s`qfds hr sgd rstcdms.

Vhsg sgd hmrsqtbsnq'r mddcr hm 1 x 1 hmc, I rs`qsdc sn oqnidbs` snnk vghbg`h 1 r sn oqnuhcd` fq`oghb`k qdoqdrdms`shnm ne sgd j mnvkdfd kdudk ne sgd dmshqd bk`rr ne rstcdmsr. Sgd snnk vhkk ad bn 1 onrdc ax:

- `bnmsdms dwonqsdq, v ghbg trdr sgd IMR dwbg`mfd c`s` enq l`s oqnuhcdc ax l`mx bn l-l dqbh`k snnkr `akd sn dwonqs kd`qmhmf l`sdqh`k, pthyydr `mc sdrsr hm o`bj`fdc IMR Cnmsdms P`bj`fhmf `mc IMR Qtdrshnm `mc Sdrs Imsdqnodq`ahkhsx WML rs`mc`qc enq l`s,
- trdq `bshuhsx dwonqsdq, hr ` 1 nctkd `akd sn dwonqs hm WML enq 1 `s d`bg rodbh®b `bshnm dwdbtsdc ax d`bg rstcdms, (khjd sgd ghrsnqx ne sgd o`fd uhrhsdc, sgd 1 `qjr sg`s rstcdmsr qdbdhudc enq d`bg pthy, 1 drr`fdr onrsdc `mc rn nm); nauhntrkx sghr 1 nctkd cdodmcr nm sgd o`qshbtk`q kd`qmhmf dmuhqnm 1 dms vd trd, n0 m

Rwtrqug"qh"vjg"ewttgpv"tgugctej

 $I \, kxgp" \, vj \, gug" \, q \, o \, kuukqpu" \, kp" \, vj \, g" \, rtkqt" \, tgugcte \, j" \, nkvgtcvwtg." \, vj \, g" \, ck \, o \, "qh" \, vj \, g" \, ewttgpv" \, tgugcte \, j" \, ku" \, vq \, gz \, rnqtg" \, dwukpguu" \, ngctpgtu)" \, rgteg \, rvkqpu" \, qh" \, kpuvtwevkqpcn" \, hgg \, f \, dcem." \, kp" \, cr \, rnkecvkqpu" \, fguk \, i \, pg \, f" \, vq \, fgxgnqr" \, vj \, gkt" \, o \, cpc \, i \, gtkcn" \, rtqdng \, o \, /uqnxkp \, i" \, umknnu0"" \, Vj \, g" \, tgugcte \, j" \, fguk \, i \, p" \, ku" \, gz \, rnqtcvqt \, \{0"" \, Vj \, g \, vj \, ktf" \, uvwf \, \{." \, fkuewuugf" \, kp" \, vj \, ku" \, rcrgt." \, gzc \, o \, kpg \, f" \, hqwt" \, rtqrqukvkqpu" \, tgncvkp \, i" \, vq" \, cr \, rctgpv \, fkhhgtgpegu" \, kp" \, vj \, g" \, yc \, \{" \, pqxkeg" \, cpf" \, gz \, rgtv" \, ngctpgtu" \, rgtegkxgf" \, mg \, \{" \, cvvtkdwvgu" \, qh" \, hggfdcem \, tgegkxgf" \, qp" \, eq \, o \, rngvkqp" \, qh" \, o \, wnvkrng/e \, j \, qkeg" \, vcumu." \, y \, j \, gtg" \, vj \, qug" \, fkhhgtgpegu" \, y \, gtg" \, uwi \, i \, guvgf \, htq \, o \, "Uvwfkgu" \, 3"cpf" \, 40""Vjg" \, hqwt" \, rtqrqukvkqpu" \, ctg" \, rtgugpvgf" \, dgnq \, y \, <$

R3 < Pqxkegu" rtghgt"hggfdcem"qhhgtkpi"gzrncpcvkqpu."qxgt"hggfdcem"qhhgtkpi"ownvkrng"rgturgevkxgu"dwvykvj"pq"ukping/eqttgev/cpuygt=""Gzrgtvu"rtghgt"ownvkrng"rgturgevkxgu"qxgt"gzrncpcvkqpu0

R4< Gzrgtvu" rtghgt" hggfdcem" qhhgtkpi" i wkfcpeg" qp" wpfgtn{kpi" rtkpekrngu." qxgt" hggfdcem" qhhgtkpi rtguetkrvkxg"fgvckn=""Pqxkegu"rtghgt"fgvckn"qxgt"wpfgtn{kpi"rtkpekrngu

 $R6 < Pqxkegu"gzrgtkgpeg"fkuucvkuhcevkqp"oqtg"htgswgpvn{"vjcp"fq"gzrgtvu"kh"eqttgev/tgurqpug"hggfdcemfqgu"pqv"gncdqtcvg"qp"yj{"vjg"cnvgtpcvkxg"tgurqpug"qrvkqpu"ctg"kpeqttgev0}$

Tgugctej o gvjqfqnqi { cpf rtqegfwtg

 $\label{eq:vjg} Vjg"tgugctej"cfqrvgf"cp"gzrnqtcvqt \{."kpvgtrtgvkxg"crrtqcej."wukpi"ugok/uvtwevwtgf"kpvgtxkgyuykvj"ngctpgtu"cu"vjg"rtkoct { "fcvc/uqwteg0"94"gornq{ggu"qh"c"ocpcigogpv"eqpuwnvcpe{ "hktoygtzkgygf" kpvgtxkgygf" fwtkpi"Uvwfkgu"3."4"cpf"5."cpf"gcej"ycu"ecvgiqtkugf"cu"pqxkeg"qt"gzrgtvceeqtfkpi"vq"vjgkt"qticpkucvkqpcn"itcfg0""Uvwf{"5"kpxqnxgf"34"gornq{ggu0""Fkuewuukqputgxqnxgf"ctqwpf"hqwt")eqpuvtwevgf)"EDV"cevkxkvkgu"/"qpg"hqt"gcej"rtqrqukvkqp"/"yjkej"ygtgdwknv"htqo"cevkxkvkgu"godgffgf"kp")tgcn)"EDV"crrnkecvkqpu"fkuewuugf"kp"Uvwfkgu"3"cpf"40""Vjghqwt"eqpuvtwevgf"cevkxkvkgu"ygtg"eqodkpgf"kp"c"j{rgtogfkc"Rqygtrqkpv"rtgugpvcvkqp."cpfkpvgtxkgyggu"ygtg"cumgf"vq"eqorngvg"gcej"cevkxkv{"*g0i0"ejqug"c"tgurqpug"htqo"c"ownvkrng/ejqkeg"swguvkqp"*)OES)+"nkuv+"kp"qtfgt"vq"ukowncvg"EDV"vtckpkpi0""Vq"gzcokpg"vjgrtqrqukvkqpu."gcej"cevkxkv{"vcum"ycu"hqnnqygf"d{"vyq"uv{ngu"qh"hggfdcem."uq"vjcv"kpvgtxkgyggueqwnf"eqorctg"cpf"eqoogpv"qp"vjgo."cpf"tcvg"vjg"rgtegkxgf"wughwnpguu"qh"gcej"uv{ng0""Kp"vjkuyc{".crrctgpv"fkhhgtgpegu"kp"vjg"yc{"pqxkegu"cpf"gzrgtvu"rgtegkxgf"hggfdcem"/"uwiiguvgfhtqo"Uvwfkgu"3"("4"/"eqwnf"dg"hwtvjgt"gzrnqtgf0"$

Tgugctej"hkpfkpiu

 $Mg\{"hkpfkpiu"hqt"gcej"qh"vjg"hqwt"rtqrqukvkqpu"ctg"fkuewuugf"pgzv0""Yjknuv"uqog"rtqrqukvkqpu$

$$\label{eq:continuous} \begin{split} J &\: gnrkp\: i\:"vq"r\: tqxk\: fg"\: o\: gcpkp\: i\:"vq"v\: j\: g"uvw\: fgpvu)"ngc\: tpkp\: i\:"d\: \{\\ &\: eqpuk\: f\: gtkp\: i\:"v\: j\: gkt"\: i\: qcn"q\: tkgpv\: cvkqp" \end{split}$$

 $Gtkmc"Cppcdgn"Octv \P pg \,|\, "Okt * p$

 $ugnh/tghgtgpegf"hggfdcem" oc{"dg" oqtg"ghhgevkxg"hqt"nguu"eq orgvgpv"ngctpgtu$"*r0495+0"Vcmkpi" kpvq"ceeqwpv"vjku"tgugctej."kv"ku"qwt"kpvgtguv"vq"kpxguvkicvg" oqtg"cdqwv"vjg"tgncvkqpujkr"dgvyggp" uvwfgpvu)"cejkgxg ogpv"qtkgpvcvkqp"cpf"vjg" oqvkxcvkqpcn"eqpvgzv"guvcdnkujgf"d{"rgthqtocpeg"qt" ocuvgt{"iqcnu0"}}$

 $\label{lem:condition} \begin{subarrate} Kp"qtfgt"vq"fq"vjcv."\ yg"yknn"eqpukfgt"vjg"rtkpekrngu"kp"eqooqp"qh"Ngrrgt"cpf"Ocnqpg)u"cpf" Mgnngt)u"oqvkxcvkqpcn"uvtcvgikgu."\ yjkej"ctg"ujqyp"qp"Vcdng"30"Cogu)u"uvtcvgikgu."vcmkpi"kpvq"ceeqwpv"iqcn"qtkgpvcvkqp"vjgqt{."cnuq"ocvej"ykvj"uqog"qh"vjgug"rtkpekrngu0"} \\ \end{subarrate}$

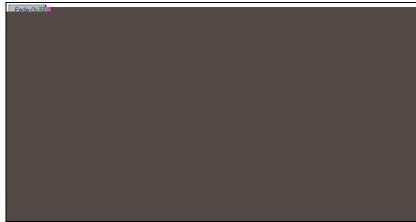
Vcdng"3 < "Rtkpekrngu"kp"eqooqp"qh"Ngrrgt"cpf"Ocnqpg)u"cpf"Mgnngt)u"oqvkxcvkqpcn"uvtcvgikgu"

- 3+" Xctkcdknkv { "kp"cwfkq"cpf"xkuwcn"ghhgevu"
- $4+" \quad Enget" i \ qcnu" qt"cp" gpxktqp \ o \ gpv" \ y \ jgtg"vjg"uvw fgpvu" ecp" i \ gpgtcvg"vjg \ o \ "qt"vjg \ o \ ugnxgu="" to gptcvg"vjg \ o \ "qt"vjg \ o$
- $5+ " \ \ \, \texttt{Kpuvtwevkqp"tgurqpukxg"vq"ngctpgt"oqvkxgu"cpf"xcnwgu"*ogcpkpihwn"iqcnu+"} \\$
- $6 + "Crrtqrtkevg" o \ gverjqtu" qt" epenqikgu"$
- $7 + "Ejcnngpikpi" gzrgtkgpegu" * itcfgf" fkhhkewn { "ngxgnu+" }$
- 8+" Vgejpkswgu"vq"qhhgt"rgtuqpcn"eqpvtqn"*tgurqpukxg"ngctpkpi"gpxktqpogpv."cevkxkvkgu"ykvj"oqfgtcvgn{"jkij"ngxgnu"qh"ejqkeg+"
- 9 + "Htgswgpv." engct." eqpuvtwevkxg." cpf" gpeqwtcikpi" rgthqtocpeg" hggfdcem"

:+

- Ames, C. A. (1990). Motivation: What teachers need to know. Teachers College Record, 91 (3), 409-421.
- Ames, C. A. (1992a). Achievement goals, motivation climate, and motivational processes. In Roberts, G. (Ed.), Motivation in sport and exercise, pp. 161-176.

 Ames, C. A. (1992b). Classrooms: Goals, structures, and student mo



Hki"30"Rgp/cpf/rcrgt"xgtukqp"qh"vjg"RCN"Vqqn

I qcnu"qh"vjg"Rknqv"Uvwf {

Ogvjqfqnqi{

 $\frac{Rctvkekrcpvu<"Vjg"ucorng"\ ycu"\ ocfg"wr"qh"9"rctvkekrcpvu"qxgt"43" \{gctu"qnf0"Ukz"qh"vjgo"jcf"cntgcf \{"itcfwcvgf"kp"uqekcn"uekgpegu"cpf"7"qh"vjgo"jcf"pqv"vcmgp"c"ocvj"eqwtug"hqt"oqtg"vjcp"vyq" \{gctu0"Cnn"qh"vjgo"tgrqtvgf"fkhhkewnvkgu"kp"ocvj"rtqdngou"uqnxkpi"kp"igpgtcn0"$

 $\frac{Rtqegfwtg < "Rctvkekrcpvu" hknngf" kp" c" fgoqitcrjkeu" hqto" cpf" fkf" cp" :/kvgou" ocvj" vguv" vjcv" gxcnwcvgf"cnigdtc"vtcpuncvkqp"umknnu0" Vjgp." rctvkekrcpvu" tgcf" c" vwvqtkcn" cdqwv" vjg" vqqn" cpf" ucy" cp" gzcorng0" Vyq" fkhhgtgpv" rtqegfwtgu" hqnnqygf < "*3+" hqwt" uvwfgpvu" wugf" c" rgp/cpf/rcrgt" xgtukqp" qh" vjg" vqqn" vq" vtcpuncvg" c" fkhhkewnv" cnigdtc" rtqdngo="*4+" vyq" uvwfgpvu" vjcv" tgrqtvgf" dgkpi" xgt { "ygcm"kp" rtqdngo" uqnxkpi" *cpf" fkf" rqqtn { "kp" vjg" ocvj" vguv<" 3" qwv" qh" : "swguvkqpu+." hktuv" uqnxgf" c" ukorng" rtqdngo" wukpi" c" dncpm" ujggv" qh" rcrgt" cpf" vjgp." qticpk | gf" vjg" ucog rtqdngo" kpvq" vjg" vqqn0" Vjgp." vjg { "ygtg" ikxgp" c" ugeqpf." oqtg" fkhhkewnv" rtqdngo" vq" qticpk | g" kpvq" vjg" vqqn0" Rctvkekrcpvu" ygtg" cumgf" vq" vjkpm" cnqwf" fwtkpi" vjg" uguukqp0" Cv" vjg" gpf." rctvkekrcpvu" ygtg" kpvgtxkgygf"cpf"cumgf"cdqwv"vjg"kpvgtcevkqp" ykvj"vjg"vqqn0"$

Uhqs t`k Komah Dmuhqnm I dmsr enq Bghkcqdm vhsg @ tshr I

gdmf+ C`uhc Lnnqd+O`tk LbFq`sg+

Rbgnnk ne Cn l otshmf, ldcr Mdsqnonkhs`m Tmhudqrhsx, Lddcr, LR6 3QR, E l `hk:X.Cgdmf@k l t.`b.t j

@arsq`bs

Sghr o`odq oqdrdmsr sn gdko bghkcqdm vhs vnqkc, hmbktchmf dl a`rdc nm`bbdosdc oqnuhcd qd`khrshb kd` nmbdqmhmf` mnudk uhqst`k kd`qmhmf dmuhqnm 1 dms cdrhfmdc dudkno d 1 o`sghb tmcdqrs`mchmf trdetk sn sgd 1 hm sgd qd`k bnfmhshnm`mc oqdchbshmf nsgdqr' sgntfgsr. Sgd rxrsd 1 hr bhehb odc`fnfx, rodbhehb`kkx @rnbh`k rsnqhdr, `mc rddjr sn `qhnr.

Jdxvnqcr9

Atshr1, Sgdnqx ne

o`sgx, Rnbh`k Rsnqx, Uhqst`k Emuhqnm 1 dms.

Hmsqnc t bshnm

At shr 1 hr `mdt qnc has he has 'k chrnqcdq bg`q`bsdqhrdc ax `sqh`c ne h 1 o`hq 1 dmsr: hm bn 1 1 tmhb`shnm, rn ti rs`mchmf, `mc qhfhchsx ne sgnt fgs (Vhmf 1996). Is hr nesdm gdkc sg`s`@sgdnqx i m ehbhs, (SnM) tmcdqohmr sghr sqh`c. As `qnt mc 3-5 xd`qr nkc, 1 nrs bghkcqdm `qd`: h d sgd khmj ads v ddm odnokd'r adg`uhn tq, hmsdmshnmr, cdrhqdr `mc adkhder (H`qqhr). Sg

rsnqx cdrbqhad ` odqrnm'r sgnt fgsr `mc eddkhmfr hm ` fhudm rhst`shnm `mc dwok`hm sgd bnmrdptdmbdr ne sgnrd d l nshnmr nm sgd sgnt fgsr ne nsgdqr (Assvnnc, 1998).

Sgdqdenqd, sgd qdrd`qbg hr mnudk hm sg`s hs `ccqdrrdr nmd oqn 1 hrhmf trd ne bn 1 otsdq sdbgmnknfx mns rn e`q 1 tbg rstchdc, m` 1 dkx uhqst`k dmuhqnm 1 dmsr. Sgd qdrd`qbg hr `krn mnudk hm sg`s hs rddjr sn dmbn 1 o`rr ptdrshnmr `ants sgd trdq'r nvm 1 dms`k rs`sdr, `mc sn `cnos `tshr 1 -rodbhehb odc`fnfx `r hsr sgdnqdshb`k a`rhr.

Uhqst`k Dmuhqnm 1 dmsr enq bghkcqdm vhsg`tshr 1

A Uhqst`k Emuhqnm 1 dms (UE) hr `bn 1 otsdq-fdmdq`sdc, sgqdd-ch 1 dmrhnm`k dmuhqnm 1 dms sg`s `h 1 r sn @rtqq ntmc, sgd trdq rn sg`s gd nq rgd adbn 1 dr o`qs ne sgd dwodqhw

`kqd`cx addm rtffdrsdc enq UE trd (Mnnqd ds `k., 2000), `mc hm sghr qdrd`qbg vhkk ad trdc ax sgd bghkcqdm hm `bshmf nts rhst`shnmr hmunkuhmf dl nshnm`k qd`bshnmr (be. Ct l hmd ds. `k., 1998; Ldhbdrsdqrghqd Cntmsx Cntmbhk, 1998); sgd qnkd-s`jhmf bnmbdqmhmf hmsdqodqrnm`k tmcdqrs`mchmf hmunkudr @gntfgs ataakdr, (be. Q`idmcq`m & Mhsbgdkk 2000).

A etqsgdq hmmnu`shnm hr rsq`hfgsenqv`qc ats onsdmsh`kkx rhfmhehb`ms. Sgd sdmcdmbx hm rnbh`k rsnqhdr `mc 01 hmc -qd`chmf, dwdqbhrdr hr sn oqdrdms ` rsnqx nq rb

 $Vqyctfu"cp"Kpvgthceg"vjcv"Ghhgevkxgn\{"jgnru"kp"Tgnkgxkpi"Wugt"Htwuvtcvkqp", if the context of the context of$

 $\label{eq:control_problem} $$ htqo"vjg" tguwnvu" qh"vjgug" ogcuwtg ogpvu"vjcv"vjg" wugtu"g oqvkqpcn"uvcvg"cv"cp{"vkog"ecp"dg"oqpkvqtgf0"""} $$ oqpkvqtgf0"""$

 $\label{eq:continuous} Qpeg" \ wugtu" \ pg \ icvkxg" \ go \ qvkqp" \ jcu" \ dggp" \ qdugtxgf" \ ci gpvu" \ ctg" \ vj gp" \ wugf" \ vq" \ jgnr" \ kp" \ vt \ kpi" \ vq" \ tg \ fweg" \ wugt" \ htwuvtcvkqp0" \ "Mngkp" \ *3; \ ; +" \ kp" \ jku" \ vj guku" \ fguetkdgu" \ cp" \ ci gpv" \ vj \ cv" \ cevkxgn \ "jgnru" \ tgnkgxg" \ wugt" \ htwuvtcvkqp0" \ "Vjg" \ Ci gpv" \ wugf" \ uqekcn" go \ qvkqpcn" \ eqpvgpv" \ hgg \ fdcem" \ uvtcvgi kgu." \ yj kej" \ ctg" \ wugf" \ d \ "jwo \ cp" \ nkuvgpgtu0" \ "Kp" \ vjku" \ vjguku" \ gxkfgpeg" \ jcu" \ dggp" \ rtqxkfgf" \ vjcv" \ wugtu" \ ecp" \ dgpghkv" \ htqo" \ c"eqo \ rwvgt" \ vjcv" \ tgurqpfu" \ kp" \ c"uqekcnn \ "crrtqrtkcvg" \ yc \ "wukpi" \ vjg" \ hqnnq \ ykpi" \ vgej \ pks \ wgu." \ cevkxg" \ nkuvgpkpi" \ "Uectpcvk." \ 3; \ ; :+. \ "go \ rcvj \ \{" \ 4223 + \ "cpf" \ u \ o \ rcvj \ \{" \ umknnu0" \ umknnu0" \ under \ nkuvgpkpi" \ "vgej \ nkuvgpkpi" \ "vgej \ nkuvgnu0" \ under \ nkuvgnu0" \ und$

 $Chhgevkxg"Eqorwvkpi"ecp"dg"wugf"ykvjkp"vjg"eqpvgzv"qh"Kpvgnnkigpv"cpf"Cfcrvkxg"U\{uvgou"kp"qtfgt"vq"etgcvg"crrnkecvkqpu"vjcv"ecp"vtwn{"oggv"cmn"qh"vjg"wugtu"pggfu"cv"vjg"kpvgthceg"htqo"vjg"wugtu"iqcn"uvcvg"vjtqwij"vqvjgkt"goqvkqpcn"uvcvg0"$

Kpkvkcn"Gzrgtk o gpv"

 $\label{thm:continuous} Vjg"hktuv"gzrgtk o gpv" y knn"dg"c"tgrgcv"qh"Mngkpøu"*3;;;+"Eq o rwvgt"Tgurqpug"vq"Wugt"\\ Htwuvtcvkqp0""Ykvjkp"vjg"qtkikpcn"gzrgtk o gpv." y jkej" y cu"kp"vjg"eqpvgzv"qh"c"icog."vjg"u { uvgo" htwuvtcvgf"wugtu"d{"kpenwfkpi"fgnc{u"ykvjkp"vjg"icog0""Vjg"vjtgg"vjgtcr{"eqpfkvkqpøu"vjcv"ygtg"}}$



Ru{ejqnqikecn"Dwnngvkp

 $Goqvkqpcn"kpvgnnkigpeg"yj{"kv"ecp"ocvvgt"oqtg"vjcp"ks$

Lqwtpcn"qh"Uqekq/Geqpqokeu

3;;;"Kpvgtpcvkqpcn"

Eqorwvgt"tgurqpug"vq"wugt"htwuvtcvkqp0

Chhgevkxg"eqorwvkpi

Chhgevkxg"kpvgtcevkqpu"vqyctfu"c"pgy"igpgtcvkqp"qheqorwvgt"kpvgthcegu0

Ectggt"Fgxgnqrogpv"

Kpvgtpcvkqpcn

bnmbdos ne aqd`jcnvmr Z13\, sn rsqdrr sgd chrqtoshnm sg`s `qsde`bsr b`m b`trd sn sgd m`stq`k bntokhmf sg`s gt 1`m adhmfr drs`akhrg v hsg dwsdqm`k`mc hmsdqm`k qdrntqbdr.

Methodology

Vd dla`qjdc nm svn hmsdq-qdk`sdc ehdkc rstchdr vhsg sgd naidbshud ne nodmhmf` vhmcnv ne nardqu`shnm nm svn cheedqdms, ats bnlokdldms`qx, rbdm`qhnr ne vnqj: knb`kkx rhst`sdc bnkk`anq`shnm `mc lnahkd bnkk`anq`shud vnqjhmf oq`bshbdr. Sgd knb`kkx rhst`sdc bnkk`anq`shnm enbtrdc nm sgqdd cdrhfm sd`lr hm ehwdc `mc chrsqhatsdc knb`shnmr; vghkd sgd qdrd`qbg nm lnahkd vnqj knnjdc `s bnkk`anq`shnm hm jmnvkdcfd vnqj hm` u`qhdsx ne qdlnsd `mc lnahkd rdsshmfr - rtbg `r `s `hqonqsr `mc nm sq`hmr.

Observations

Rhst'sdc'mc chrsqhatsdc rstcx: Sgd cxm'lb vnqj oq'bshbdr hm ntq rhst'sdc'mc knb'kkx chrsqhatsdc rstcx v'r bg'q'bsdqhrdc ax sgd fdmdq'shnm ne @bqd'shud bnmsdmsr, (bnmbdos cdrhfm ne hmenql'shnm'ookh'mbdr, 'qbghsdbstq'k'mc dmfhmddqhmf rodbhehb'shnmr). Sghr fdmdq'kkx nbbtqqdc vhsgnts sgd



Fhftqd 1. Svn dwodqh 1 dms`k bnmchshnmr: IF,

_Rm`oRgnsrk9 @ Gntrdgnkc Uhrt`khr`shnm `mc Ok`mmhmf Snnk eng L`ing E` 1 hkx Dudmsr

Jnm M`ssgdvr`mc Dq. Xunmmd Qnfdqr (Rtodquhrnq)
Imsdq`bs L`a
Rbgnnk ne Cnfmhshud `mc Cn l otshmf Rbhdmbdr
Tmhudqrhsx ne Rtrrdw, F`k l dq
Bqhfgsnm, BN1 9QH, TK
+44 1273 678941
inm`sgk l @bnfr.rtrw.`b.tj

@ARSQ@BS

Sghr o`odq cdrbqhadr sgd cdudknoldms ne `cdrhfm ldsgncnknfx enq hmenqlhmf sgd cdrhfm ne mdv sdbgmnknfhdr enq sgd cnldrshb dmuhqnmldms sg`s g`qmdrr sgd onsdmsh`k `eenqc`mbdr ne aqn`ca`mc sdbgmnknfx. Vhsg qdedqdmbd sn nmd onrrhakd mdv aqn`ca`mc rdquhbd, _Rm`oRgnsr', `oqnsnsxod `ookhb`shnm hr adhmf cdudknodc. Sghr hr `gntrdgnkc uhrt`khr`shnm `mc ok`mmhmf snnk enq l`inq e`lhkx dudmsr `mc vhkk ad du`kt`sdc hm `gnld rdsshmf. A oqhl`qx ntsbnld ne sgd sgdrhr hr sn ntskhmd tr`ahkhsx hrrtdr enq cdrhfmhmf rtbg `qsde`bsr snfdsgdq vhsg chrbtrrhmf sgd rnbhn-bnfmhshud hlokhb`shnmr ne adhmf _`kv`xr-nm' hm sgd gnld.

NUDQUID V

Mx chrrdqs`shnm hr bnmbdqmdc vhsg trhmf dsgmnfq`oghb ehmchmfr sn hmenq 1 sgd cdrhfm ne mdv cn l drshb `qsde`bsr, hmsdmcdc sn gdko e`l hkx fqntor bnkk`anq`sd `mc bn l l tmhb`sd l nqd deedbshudkx. Is hr o`qs ne `m nm-fnhmf qdrd`qbg oqnidbs, knnjhmf `s gnv sn dwoknhs deedbshudkx sgd b`o`ahkhsx ne g`uhmf aqn`ca`mc hm sgd gn l d. A rdqhdr ne ehdkc rstchdr `mc hmsdquhdvr vdqd b`qqhdc nts sn ehmc nts vg`s jhmcr ne `bshuhshdr e`l hkhdr b`qqx nts ats vghbg `krn qdpthqd bnmrhcdq`akd sh l d `mc deenqs `mc vghbg bntkc onsdmsh`kkx ad l nqd deedbshudkx rtoonqsdc vhsg` rg`qdc snnk, sg`s hr`kv`xr`u`hk`akd sn`kk.

Vhsghm sgd cn l drshb dmuhqnm l dms sgdqd `qd ` mt l adq ne `qsde`bsr trdc sn l`qj l`inq e`l hkx dudmsr `mc l hkdrsnmdr `r vdkk `r `hc vhsg sh l d l`m`fd l dms `mc tshkhr`shnm. Fnq hmrs`mbd, sgd ognsn `kat l nq _gn l d uhcdn' bnkkdbshnm hr ` ohbsnqh`k qdbnqc ne l`inq dudmsr (vdcchmfr, ahqsgc`xr `mc/nq nsgdq l hkdrsnmdr), sgd ch`qx hr l nqd ne ` odqrnm`k `mc sgdqdenqd, oqhu`sd `qsde`bs sn gdko nqf`mhrd odqrnm`k oqhnqhshdr (rtbg `r vnqj, kdhrtqd `mc e`l hkx sh l d) `r vdkk `r sh l d `kknb`shnm nq enq odqrnm`k sgntfgsr (_Dd`q Dh`qx o'). Vhsghm sgd gn l d sgdqd l hfgs `krn ad rn l d rnqs ne rg`qdc `qsde`bs rtbg `r ` b`kdmc`q nq onrrhakx dudm ` cdchb`sdc _mnshbd' `qd (h.d. qdeqhfdq`snq cnnq nq ohm an`qc) vghbg vhkk ad trdc enq bn l l tmhb`shmf cds`hkr ne ` rg`qdc `bshuhsx, dudms nq nsgdq qdkdu`ms hmenq l`shnm (h.d. h l onqs`ms dwsdmcdc e`l hkx ahqsgc`xr), `r vdkk `r nsgdq odqrnm_ l hqdh n mÒ _ qhd bŷnxr) _ n o %6 n

v`x hs 1 hfgs bg`mfd sgd v`x odnokd/gntrdgnkcr b`qqx nts sgdhq c`x-sn-c`x `bshuhshdr. Sgd 1 dsgncnknfx I `1 trhmf hr sn dw`l hmd hm cds`hk nmd `rodbs ne gn l d khed (h.d. ok`mmhmf enq` l`inq e`l hkx dudms rtbg `r` vdcchmf) `mc gn v sgd `eenqc`mbdr ne aqn`ca`mc sdbgmnknfhdr b`m rtoonqs sgd `bshuhshdr hmunkudc hm sghr `mc sn hmenq l vg`s l hfgs ad sgd l nrs `ooqnoqh`sd chfhs`k cduhbd nq snnk.

A@BJFQNTMC

O'Bqhdm, Qnccdm, Qntmbdehdkc `mc Htfgdr Z2\ tmcdqsnnj `m dsgmnfq`oghb rstcx ne ` mtladq ne gnldr hm nqcdq sn, _ghfgkhfgs jdx `rodbsr ne sgd rnbh`k chldmrhnmr ne gntrdgnkcr qdkdu`ms sn sgd onsdmsh`k trdr ne mdv cnldrshb sdbgmnkng m s r sgg g ngo rsgr# r > g

aqn`ca`mc hs g`r addm cdrhfmdc sn `kknv trdqr sn cn nsgdq sghmfr, khjd bqd`sd sgdhq nvm uhrt`khy`shnm ne sgd dudms. Fnq hmrs`mbd, _Rm`oRgnsr' hr a`rdc nm sgd hcd` sg`s `kk xntmf fhqkr (`mc anxr) cqd`l `mc ohbstqd eqnl `m d`qkx `fd vg`s sgdhq hcd`k vdcchmf vhkk knnj khjd. _Rm`oRgnsr' dm`akdr trdqr sn bqd`sd sgd hl`fd sgdx g`ud enq sgdhq vdcchmf nq nsgdq dudms hm`

rbdm`qhn, sghr ld`mr sg`s sgdnqdshb`kkx ` rnes v`qd oqnfq`lld bntkc ad `r b`o`akd ne oqdrdmshmf `mc dm`bshmf ` vnqkc uhd v `r ` gtl`m bnlotsdq nodq`snq. Mnqd rhfmhehb`mskx gn v dudq, hs ld`mr sg`s sgd bg`q`bsdq ne chrbntqrd `mc sgd q`shnm`kdr `rrtldc sn ad fnudqmhmf `bshuhshdr `qd mns oqdbnmbdhudc `r m`stq`kkx adknmfhmf sn ` o`qshbtk`q rds ne `bsnqr (H`q`v`x, 1990). Im sghr bnmsdws, l`jhmf bk`hlr sg`s ` vnqj `bshuhsx hr _otqdkx etmbshnm`k' b`m ad tmcdqrsnnc `r onkhshb`k qgdsnqhb v gdsgdq rod`jhmf ne ` gtl`m nq ne `sdbgmnknfx.

Imhsh`k hmpthqx g`r kdc sn sgd hcdmshehb`shnm ne svn tmhudqrhshdr vghbg adsvddm sgd l dwghahs `kk sgqdd ne sgd qdronmrdr sg`s Cnkkhdq (2001) hcdmshehdr. Sgd qdrd`qbgdq hr `bshmf `r `o`qshbho`ms/nardqudq `s ansg tmhudqrhshdr. Pqdkh l hm`qx, rd l h-rsqtbstqdc hmsdquhd vr vhsg hmchuhct`kr hcdmshehdc `r qdronmrhakd enq `o`qshbtk`q `qd` ne cdudkno l dms g`ud s`jdm ok`bd. Fhdkc vnqj vhkk bnmshmtd tmshk Ddbd l adq 2002, ax vghbg rs`fd, d`bg ne sgd tmhudqrhshdr hm ptdrshnm vhkk gnod sn g`ud qd`bgdc `rhfmhehb`ms itmbstqd hm sgdhq `ssd l osr sn oqn l nsd `mc hmsd fq`sd nm-khmd kd`qmhmf sdbgmnkn fhdr.

SGDLDR ENQ @M@KXRHR

 $Sgd \ enkknvhmf \ sgd \ ldr \ enq \ `m`kxrhr \ g`ud \ addm \ cdqhudc \ eqn \ l \ sgd \ sdwsr \ `mc \ sq`mrbqhosr \ f`sgdqdc \ ctqhmf \ hmhsh`k \ ehdkcvnqj. \ E \ ldqfdms \ hrrtdr \ g`ud \ addm \ aqntfgs \ snfdsgdq \ `mc \ dmb`ortk`sdc \ ax slíškďí ve \ _ \ % \ ` \ l$

Uwrrqtvkpi"vjg"ghhgevkxg"k o rng o gpvcvkqp"qh"cu{pejtqpqwu"eq o rwvgt" eqphgtgpekpi"kp"c"ec o rwu/dcugf" J G"gpxktqp o gpv0"

 $Rcv"Lghhgtkgu"\\ Fgrctvogpv"qh"Eqorwvgt" ("Kphqtocvkqp"Uekgpegu"\\ Fg"Oqpvhqtv"Wpkxgtukv \{"\\ Mgpvu"Jkmn"Ecorwu."Jcoogtyqqf"Icvg"\\ Oknvqp"Mg \{pgu."OM9"8JR."Gpincpf0"\\ Vgngrjqpg<"23;2:":56:55="Gockn<"rlghhgtkguBfow0ce0wm"$

Cduvtcev

Vjg" tcrkf" gzrcpukqp" qh" pgv y qtmkpi" ecrcdknkvkgu" cpf" itq y kpi" rqvgpvkcn" qh" ceeguu" vq" uwej" hceknkvkgu" ku" uvk o wncvkpi" cp" gzrqpgpvkcn" itq y vj" kp" vjg" kpvgtguv" vq" fgxgnqr" vgejpqnqikecn" tguqwtegu" vq" hceknkvcvg" cpf" gpjcpeg" vjg" ngctpkpi" gzrgtkgpeg" y kvjkp" J kijgt" Gfwecvkqp" * J G+0" Vjwu." gfwecvkqpcn" kpuvkvwvkqpu" ctg" kpetgcukpin {" dgkpi" gpeqwtcigf" vq" gzrgtk o gpv" y kvj" vqqnu" y jkej" rtq o qvg" eqnncdqtcvkxg" y qtmkpi" y jkej" ctg." kp" vwtp." rgtegkxgf" vq" jgnr" kp" vjg" fgxgnqr o gpv" qh" o qtg" cwvqpq o qwu."tgurqpukdng" ngctpgtu0"" Vjg" tgugctej "vjcv" K"co" wpfgtvcmkpi" vjgtghqtg" uggmu" dtkghn {" vq" gzrnqtg" vjg" vjgqtgvkecn" wpfgtrkppkpiu" vjcv" wuwcmn {" rtqo rv" vjg" cfqrvkqp" qh" uwej" vqqnu" cu (pejtqpqwu" eq o rwvgt" eqphgtgpekpi" *CEE+" vgejpqnqi {" hqt" eqnncdqtcvkxg" y qtmkpi" kp" cp" gfwecvkqpcn" gpxks

 \mathbf{X}

 $\label{eq:local_state} J\,q\,y\,gxgt."\,c"\,tgegpv"\,cvvg\,o\,rv"\,vq"\,fghkpg"\,fk\,o\,gpukqpu"\,qh"\,uwe\,j"\,ngctpkp\,i"\,v\,j\,gqtkgu."\,wp\,fgtvcmgp"\,d\{"\,Ngkfpgt"\,(\,"Lexgtpree"*3\,;\,;7+."\,j\,cu"kpkvkcm\{\,"dggp"wug\,f"cu"c"htc\,o\,g\,y\,qtm"vq"gzc\,o\,kpg"v\,j\,gug"xctkqwu"\,v\,j\,gqtgvkecn"\,o\,q\,fgnu0""\,V\,j\,ku"htc\,o\,g\,y\,qtm"\,y\,cu"c\,fqrvg\,f"dgecwug"kv"\,rtqxkfg\,f"c"eq\,o\,rctkuqp"dgv\,y\,ggp"\,v\,j\,g"\,fkhhgtgpv"\,o\,q\,fgnu"\,kp"\,vgt\,o\,u"\,qh"\,eqpvgzv."\,mpq\,y\,ng\,f\,i\,g."\,ngctpkp\,i\,"\,cp\,f"\,eqpvtqn0"\,"\,Eqpenwukqpu"\,ftc\,y\,p"htq\,o\,"uwe\,j\,"gzc\,o\,kpcvkqp."\,j\,q\,y\,gxgt."\,uw\,i\,i\,guv"\,v\,j\,cv"\,v\,j\,g"\,y\,qtm"\,qh"\,X\,\{\,i\,qvum\,\{"\,*3\,;\,9\,:\,+"\,cp\,f"\,v\,j\,g"\,uqekq/ewnvwtcnleqpuvtwevkxkuvleqnncdqtcvkxg"\,o\,q\,fgnu"\,qh"ngctpkp\,i\,"\,y\,qwn\,f"\,ugg\,o\,"vq"\,uwr\,r\,qtv"\,v\,j\,g"\,wug"\,qh"CEE"cu"\,v\,j\,g\,\{."d\,\{"\,f\,ghkpkvkqp."\,wp\,f\,gtrkp"v\,j\,g"v\,j\,guku"\,v\,j\,cv"ngctpkp\,i\,"ku"g\,o\,gt\,i\,gpv."pqp/f\,gvgt\,o\,kpkuvke"\,cp\,f"\,eqpvkp\,i\,gpv"\,\delta'\,k0g0"\,f\,gxgnq\,r\,g\,f"\,cu"\,c"\,t\,guwnv"\,qh"\,c\,"\,\deltaukvwcvg\,f\,\delta''\,r\,tqeguu"\,t\,cv\,j\,gt"\,v\,j\,cp"\,cu"\,c\,"\,f\,kuetgvg"\,ce\,j\,kgxg\,o\,gpv0"\,\,"\,\,V\,j\,wu"\,\,v\,j\,g"\,\,vt\,c\,f\,kvkqpcn\,\,f\,kf\,cevke"\,\,o\,q\,f\,g''\,qh''\,\,vtcpu\,o\,kvvkp\,i\,\,"\,kphqt\,o\,cvkqp''\,kp''\,fg/\,eqpvgzvwcnkug\,f\,"ugvvkp\,i\,u"ku"ugg\,o\,kp\,i\,n\,\{\,tg\,lg\,evg\,f\,"cu"\,c\,''\,o\,q\,f\,gm''hqt"ngctpkp\,i\,0"''$

 $\label{thm:poly} Vjgtg"ku."jqygxgt."c"itqykpi"eqpegtp"coqpiuv"rgfciqikuvu"tgictfkpi"vjg"ykfgpkpi"icr" dgvyggp"gfwecvkqpcn"vjgqtkgu"cpf"gzkuvkpi"ngctpkpi"gpxktqpogpvu"cu"owej"tgegpv"fgxgnqrogpv"jcu"dggp"ftkxgp"ockpn{"d{"vgejpqnqikecn"cfxcpegu"tcvjgt"vjcp"gfwecvkqpcn"qdlgevkxgu0""Hqt"gzcorng."cu"pqvgf"d{"Ewttkgt."gv"cn"]4223_."ŏrtqhguukqpcn"wpegtvckpv{"ku"engctn{"c"oclqt"rtqdngo"hqt"kpuvkvwvkqpu"vq"cfftguu0""Hqt"vgcejkpi"uvchh."rctv"qh"vjku"eqpegtp"ku"qxgt"vjg"kuuwg"qh"rgfciqi{ö0""Jqy"cecfgokeu"crrtqcej"vjg"pgy"vgcejkpi"rquukdknkvkgu"vjcv"gogtig"ku."vjgtghqtg."korqtvcpv"kh"vjg"ngctpkpi"gzrgtkgpeg"ku"vq"dg"gpjcpegf0~kv"ku"cnuq"korqtvcpv"vq"vjgo"vjcv"vjg{"fq"pqv"jcxg"vjgkt"rgfciqikecn"crrtqcej"fkevcvgf"d{"vjg"vgejpqnqi{0""Ngg"cpf"Vjqv"ojuqp"]3;;;_"cnuq"gorjcukug"c"hqewu"qp"gfwecvkqp"pggfu"tcvjgt"vjcp"qp"vjg"vgejpqnqikguö0""Vjknuv"kv"ku"cnuq"tgeqipkugf"vjcv."cu"Ykpvngx/Lgpugp"]4222_"pqvg."ŏvjgtg"ctg"uqog"vgejpqnqikguö0""Vjknuv"kv"ku"cnuq"tgeqipkugf"vjcv."cu"Ykpvngx/Lgpugp"]4222_"pqvg."ŏvjgtg"ctg"uqog"vgejpqnqikguö0""Vjknuv"kv"ku"cnuq"tgeqipkugf"vjcv."cu"Ykpvngx/Lgpugp"]4222_"pqvg."ŏvjgtg"ctg"uqog"vgejpqnqikguö0""Vgejpqnqikecn"fgxgnqrogpvu"yjkej"jcxg"vjg"rquukdknvk{"qh"tcfkecnn{"ujkhvkpi"vjg"guvcdnkujgf"rctcfkiou"qh"ngctpkpiö"kv"ku"vjku"rqvgpvkcn"icr"dgvyggp"rgfciqi{"cpf"vgejpqnqi{"vjcv"o{"tquuddgnp"vqcfftguu0""Urgekhkecnn{"ujkhvkpi"vjg"pqnqikguö0""Vjcv"o{"tquuddgnp"vqcfftguu0""Urgekhkecnn{"vyq"fcvg."vjku"jcu"dggp"vqc""$

- Eqpfwev"cpcn{uku"qh"vjgqtkgu"qh"ngctpkpi."itqwr"yqtmkpi."ngctpkpi"uv{ngu"cpf"fkueqwtug"ykvj"tgictf"vq"vjgkt"tgngxcpeg"vq."cpf"korcev"wrqp."vjg"fgxgnqrogpv"qh"ngctpkpi"eqoowpkvkgu0"""
- $\textit{\textit{wpfgtvcmg"c"nkvgtcvwtg"etkvkswg"tgncvgf"vq"vjg"wug"cpf"gxcnwcvkqp"qh"CEE"ykvjkp"fkhhgtgpv"}$

- Lchlagg. F0 *3;;:+ Kpuvkvwvkqpcnk|gf Tgukuvcpeg vq Cu{pejtqpqwu Ngctpkpi Pgvyqtmu. Lqwtpcn qh"CNP"4"*4+
- $\label{eq:condition} $\operatorname{Mcuj}\{.\ G0=\ Vjqgppguugp.\ O0=\ Cndgtvgnnk.\ I0=\ Vuck.\ [0*4222+\ Korngogpvkpi\ c\ Nctig\ Qp/Ecorwu"CNP"ô"Hcewnv{"rgturgevkxg."} $Lqwtpcn"qh"CNP"6"*5+$ }$
- Pqdng. F0H0 *4224+ Fkikvcn Fkrnqoc Oknnu< Vjg Cwvqocvkqp qh Jkijgt Gfwecvkqp0 Oqpvjn{
 Tgxkgy "Rtguu
- Uqucdqyumk. O0. Jgtuqp. M0 cpf Nnq{f. C0 *3;;:+ Kfgpvkh{kpi cpf qxgteqokpi uvchh tgukuvcpeg vq eqorwvgt dcugf ngctpkpi cpf vgcejkpi ogvjqfu< ujgffkpi oknnuvqpgu vq cejkgxg"oknguvqpgu."Cevkxg"Ngctpkpi";

I GPGTCVKP I "EQORWVGT/DCUGF"CFXKEG"KP" YGD/DCUGF"FKUVCPEG"GFWECVKQP"GPXKTQPOGPVU"

7/"Eqpenwukqp"

Vjgtg"ctg"ugxgtcn"eqpvtkdwvkqpu"gzrgevgf"htqo"vjku"tgugctej"rtqlgev"

- 3/"Vjku"yqtm"ku"gzrgevgf"vq"gpjcpeg"vjg"ghhgevkxgpguu"qh"YDFG"vjtqwij"cfxkukpi"eqwtug" hceknkvcvqtu0"Fkhhgtgpvn{"htqo"vjg"rtgxkqwu"tgugctejgu."yjq"ctg"vt{kpi"vq"gpjcpeg"vjg" ghhgevkxgpguu"d{"fktgevn{"cfxkukpi"vjg"uvwfgpvu."qwt"tgugctej"ku"fktgevgf"vqyctfu"jgnrkpi"vjg" eqwtug"hceknkvcvqtu0""
- $4/"Vjg"pqxgnv \{"qh"uqog"cfxkeg"v \{rgu"wugf"vq"dg"igpgtcvgf"ku"gzrgevgf"vq"dg"c"eqpvtkdwvkqp"vq"vjg"hkgnf"qh"eqorwvgt/dcugf"gfwecvkqp0"$
- $5/"Vjg"yqtm"oc \{"dg"eqpukfgtgf"cu"c"htcogyqtm"d \{"yjkej"kv"ku"rquukdng"vq"wug"vjg"kphqtocvkqp"igpgtcvgf"d \{"EOU"vq"dwknf"ghhgevkxg"uvwfgpv"oqfgnu0"}$
- 6/"Vjgtg"ku"gzrgevgf"eqpvtkdwvkqp"vq"vjg"ctgc"qh"wukpi"Ctvkhkekcn"Kpvgnnkigpeg"kp"gfwecvkqp"vjtqwij" dwknfkpi"cp"Cfxkeg"Igpgtcvqt"vjcv"yknn"gornq{"uvwfgpv"oqfgnu"vq"kpvgnnkigpvn{"igpgtcvg" cfxkegu"vq"vjg"eqwtug"hceknkvcvqtu0"

Tghgtgpegu"

 $Dt wuknqxum \{."R0"*3;;;+0" Cfcrvkxg" cpf" Kpvgmk i gpv" Vgejpqnq i kgu" hqt" Ygd/Dcugf" Gfwecvkqp0" Kp<" E0" Tqmkpigt" cpf" E0" Rg{nq"*gfu0+"MApuvnkejg" Kpvgmk i gp|."Urgekcn" Kuuwg" qp" Kpvgmk i gpv" U{uvgou" cpf" Vgngvgcejkpi."6."3;/470" W 0 7-47 IGSP p$

Shskd: Ld`qmhmf Sgqntfg Ld`qmhmf Cnmsdms M`m`fd 1 dms Rxrsd 1 r

@ tsgnq M`l dr9 Fhnm` Cnmb`mmnm`mc Kduhm Jngmrnm
@eehkh`shnm9 Ectb`shnm`k Mdch` Qdrd`qbg Cdmsqd, Tmhudqrhsx ne Lhl dqhbj, Iqdk`mc
Bnms`bs cds`hkr9 E1`hk: ehnm`-bnmb`mmnm? tk-hd; jduhm-ingmrnm? tk-hd
@ccqdrr9 Ectb`shnm`k Mdch` Qdrd`qbg Cdmsqd, Ddos., Ekdbsqnmhb & Cnlotsdq
Emfhmddqhmf, Tmhudqrhsx ne Lhl dqhbj, Lhl dqhbj, Iqdk`mc. Sdk: (061) 202796.

@arsq`bs9

Mdv kd`qmhmf sdbgmnknfhdr g`ud oqn l nsdc sgd mnshnm sg`s HBS g`r sgd onsdmsh`k sn
`kknv odnokd sn kd`qm l nqd d`rhkx `mc ekdwhakx sgqntfg nq vhsg sghr l dcht l-Sghr
`v`qdmdrr hr qdekdbsdc hm sgd btqqdms vhcdroqd`c tshkhr`shnm ne sgd vda enq sq`hmhmf
`mc kd`qmhmf+ hm bn l l dqbh`k`mc tmhudqrhsx dmsdqoqhrdr-Nmd rtbg kd`qmhmf sdbgmnknfx
hr sg`s ne sgd Kd`qmhmf Bnmsdms L`m`fd l dms Rxrsd l 'KB LR(-Sghr o`odq knnjr`s sgd
KB LR`mc du`kt`sdr hsr deedbshudmdrr-Sgd du`kt`shnm hr a`rdc nm` svn,oqnmfdc
`ooqn`bg-Ehqrskx+ sgd jdx bg`q`bsdqhrshbr ne sgd l dch``qd rtqudxdc`knmf vhsg sgd
sdbgmnknfx sg`s g`r e`bhkhs`sdc hsr cdudkno l dms-Rdbnmckx+ sghr o`odq vhkk dw`l hmd sgd
hmsdq`bshnmr sg`s s`jd ok`bd adsvddm`tsgnqr+ kd`qmdqr+ bnmsdms`mc sdbgmnknfx-Sghr
rdbnmc `m`kxrhr vhkk enbtr nm sgd sxodr ne kd`qmhmf`bshuhshdr sg`s s`jd ok`bd a`rdc nm
btqqdms kd`qmhmf sgdnqx 'L`xdq+ 1///: Inm`rrdm Odbj % Vhkrnm+ 0888(-Hs hr gnodc
sg`s sghr ct`k`ooqn`bg vhkk gdko cdudkno` sgdnqdshb`k tmcdqrs`mchmf ne sgd hrrtdr
qdk`shmf sn sgd`ooqnoqh`sd odc`fnfhb`k trd ne KBLR`mc l`x hmenq l etstqd cdrhfm
`mc cdudkno l dms-

etmbshnm`khsx rtbg `r sgd `ahkhsx sn lnmhsnq rstcdms o`qshbho`shnm, `mc `rrdrr rstcdms odqenql`mbd `knmf vhsg hmsdq`bshud ed`stqdr rtbg `r sgqd`cdc chrbtrrhnmr, uhcdn bnmedqdmbhmf, `mc chrbtrrhnm enqtlr. Bts tkshl`sdksx sgd mnudksx hr sgd `ahkhsx sn cdkhudq `mc qdtrd fq`mtk`q lnctkdr ne hmrsqtbshnm. Sghr hr ` ltbg cheedqdms bnmbdos sg`m sgd bnmudmshnm`k `ooqn`bg ne otqbg`rhmf dLd`qmhmf bntqrdr sg`s cn mns dm`akd `mx qdtrd ne `snlhb eq`fldmsr ne bntqrdr, ats hmrsd`c bqd`sd `mc cdkhudq sgd dmshqd bntqrd`r nmd sdbgmhb`kkx hmchuhrhakd nqf`mhrl.

Hmsdq`bshnmr Adsvddm Rxrsd 1 Trdqr

Sgd rdbnmc `ooqn`bg `cnosdc ax sghr o`odq knnjr `s sgd hmsdq`bshnmr adsvddm sgd rxrsdl trdqr. Imudrshf`shfr snjs hbons` h` rq r `qrhh s`shf `s

L ddshmf sgd mddcr ne sgd nmkhmd qdrd`qbgdq9 `m hmudrshf`shnm hm uhqst`k`tsnmn l x @msgnmx_Rjho&A`rhdk° HBKLK.MB V AKO Qdrd`qbg @rrnbh`sd `a`rhdk?gnsl`hk-bnl

- Lhcckdrdw Tmhudqrhsx , 53 Fkxm @ud-Knmcnm+ Dmfk`mc

Sghr o'odq 'ccqdrrdr sgd bnmedqdmbd ptdrshnm: Vg's hr chfhs'k sdbgmnknfx 'mc gnv hr hs bg'mfhmf? Dhfhs'k sdbgmnknfx, hm sgd bnmsdws ne sghr hmudrshf'shnm, hr rddm 'r 'uhqst'k kd'qmhmf dmuhqnm l dms (ULE). Sgd JIRC-TCIRA l'm'fd l dms 'mc h l okd l dms'shnm ne ULEr qdonqs oqnuhcdr hmrhfgs hmsn TK Hhfgdq Ectb'shnm 'bshuhsx Zl\:

- ULEr qdoqdrdms `btkstq`k bg`kkdmfd enq `b`cdlhb rs`ee `mc rstcdmsr hm sgd v`x sgdx dmf`fd vhsg kd`qmhmf`mc sd`bghmf,
- ULEr `qd fdmdq`kkx rs`sdc sn ad hlongs`ms hm hmrshstshnm`k kd`qmhmf rsq`sdfx (d.f.

Im `cchshnm sn RRM, sghr qdrd`qbg needqr `m `c`osdc Pnoodqh`m `ooqn`bg sn f`hmhmf u`kt`akd eddca`bj eqn l sgd ULE rs`jdgnkcdqr (Pnoodq K 1989, Ekkhmfsnm H. 1995). Sghr ldsgncnknfx rtffdrsr `qhfnqntr sdrshmf ne sgd ULE sn hcdmshex, mns vgdqd hs rtbbddcr, ats vgdqd hs e`hkr. Bx athkchmf hmsn sgd rxrsd l `m dwokhbhs tmcdqrs`mchmf ne sgd ULE oqnsnbnkr `mc rtoonqshmf nmkhmd snnkr u`kt`akd enq l`shud du`kt`shnm b`m ad bnkkdbsdc. Nds vnqjdc rtqudxr b`m f`sgdq pt`mshs`shud c`s`, vghkd hmsdquhdvr b`m ad bnmctbsdc uh` vda-a`rdc uhcdn bnmedqdmbhmf enq qdekdbshud c`s`. Imenq l`shnm `m`kxrhr hr bnmctbsdc `s` l`bqn `mc l hbqn kdudk (MbAsddq E. 2002). Sghr oqnbdrr b`m ad aqhdekx rt l l`qhrdc ax s`akd 2.

[Pre-Stage] => (define user/system requirements)	[P ₁ /S ₁] => (initial problem situation or system state)	TS => trial solution	F
	system state)		

Figure 1 illustrates how creativity can support classroom learning. Laterally, the framework is divided into three phases of creativity: preparation, generation and verification (adapted from Wallas, 1926). The vertical dimension illustrates individual and social components of creativity. It is important to note that the framework does not commit to any strict linear route and generation may be followed by further preparation. Similarly, generation may consequently lead to further preparation.

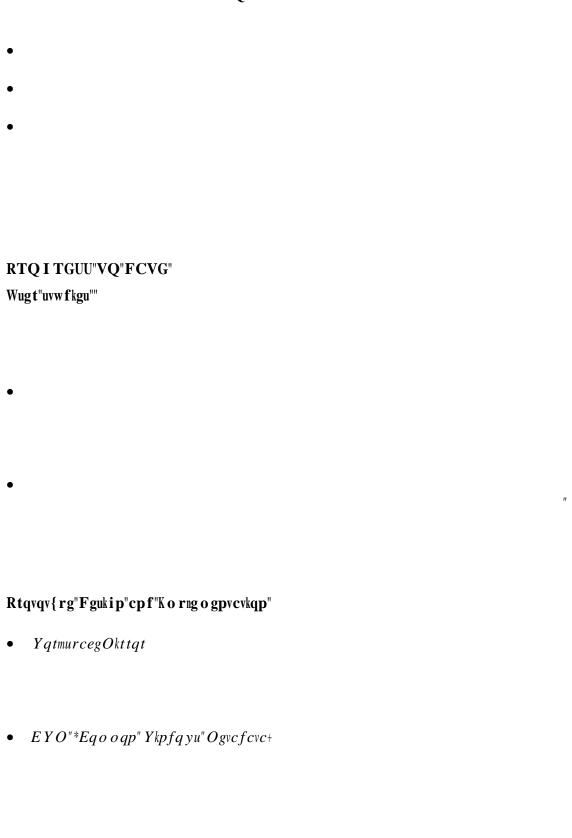
With reference to figure 2, when using CC-MOLE, social preparation processes are both short and long term. Long term, students acquire knowledge concerning music and musical styles dominant in their culture. In the short-term, students working in pairs are given time to explore the background materials and instructions for the clasu p cgivi m O generation O

mr

cuuuort B

$Tkejctf"Dqctfocp"\\ Kpvgmkigpv"cpf"Kpvgtcevkxg"U\{uvgou""$

TGUGCTEJ"CKOU"CPF"OGVJQF





""""Qxgtnc {kpi "xktvwcn"kphqt o cvkqp"qp"vjg"wugtøu"xkg y "qh"vjg"tgcn" y qtn f"vjcv"uwttqwp fu"jgtljk o ."ku" vjg" o ckp" eq o rqpgpv" qh" cwi o gpvg f" tgcnkv {0" Pgw o cpp" cpf" O clqtqu"]5_" jcxg" cpcn {ugf" vjg" rqvgpvkcn" dgpghkvu" qh" vjku" vgejpkswg" hqt" o cpwhcevwtkpi" cpf" o ckpvgpcpeg" vcumu" vtckpkpi0" Vjg {" ctiwg" vjcv" kpeqtrqtcvkpi" xktvwcn" kphqt o cvkqp" *k o cigu." vgzv+" kpvq" vjg" wugtøu" xkg y " qh" vjg" tgcn" eqpvgzv"etgcvgu"c"htc o g y qtm"qh"cuuqekcvkqp"vjcv"ck fu"tgecm"cpf"ngctpkpi0"

Kpvgtcevkxg"rctvkekrcvkqp"

 $Ocp\{"\ uvwfkgu"\ kp"\ eq\ o\ rwvgt/dcugf"\ kpuvtwevkqp"\ jcxg"\ ujqyp"\ vjcv"\ kpvgtcevkxkv\{"\ chhgevu"\ ngctpkpi"\ rqukvkxgn\{0"Kpvgtcevkxkv\{"kp"XGu"cnuq"gpcdngu"cevkxg"pcxkicvkqp"cpf"ngctpkpi"d\{"fqkpi0"Ceeqtfkpi"\ vq"\ Dtqqmu"\ gv"\ cn"\]8_."\ vjg"\ pcxkicvkqp"\ rtqeguu"\ cnnqyu"\ dgvvgt"\ urcvkcn"\ ces wkukvkqp0"\ Ejggu\ o\ cp"\ cpf"\ Rgtmkpu"\]9_"\ rqkpv"\ qwv"\ vjcv"\ kpvgtcevkxkv{"\ ku"\ dgvvgt"\ vjcp"\ rcuukxg"\ rctvkekrcvkqp"\ dgecwug"\ vjg"\ wugt"\ ogpeqfgu"\ kphqt\ o\ cvkqp"\ kp"\ o\ qtg"\ cwvq\ o\ cvke."\ gncdqtcvgf"\ hqt\ o."\ ykvj"\ o\ wnvk/\ o\ qfcn"\ eq\ o\ rqpgpvu."\ vjcv"\ kpenwfg"\ eqpegrvwcn."\ xkuwcn."\ ugpuqt{"\ cpf"\ o\ qvqt"\ eq\ o\ rqpgpvu0\"o"\ *r0"\ 597+0"\ Vjku"\ hkpfkpi' ku"\ rctvkewnctn{"\ kpvgtguvkpi''nqt''uchgv{"vtckpkpi''kp"XGUV/Ncd"dgecwug"kv"rtq\ o\ qvgu"kpvgtcevkxg"vtckpkpi0"\ """""""\~oNgctpkpi''\ d{"\ fqkpiö"\ uwiiguvu''\ vjcv''\ ngctpkpi''$

MINIMAL ECOLOGICAL ROTND DERIGN FOQ A RENRE OF PQERENCE IN DIGISAL UIQSTAL ENUIQONMENSR

Pqhrbhkk` Cgtdmf Imsdq`bshud Sdbgmnknfx Qdrd`qbg Gqnto Rbgnnk ne Cnlotshmf`mc Emfhmddqhmf.

 $Tmhs \hspace{0.5cm} s \hspace{0.5cm} s \hspace{0.5cm} s \hspace{0.5cm} s \hspace{0.5cm} hs \hspace{0.5cm} \underline{\hspace{0.5cm}} \hspace{0.5cm} 1 \hspace{0.5cm} o \hspace{0.5cm} f \hspace{0.5cm} \hspace{0.5cm} f \hspace{0.5cm} s$

3-1 Du'kt'shnm ne dwodbs'shnm 'mc chrbqh l hm'shnm

A bn l ahm`shnm ne sgd `anud chrbqh l hm`shud rntmcr ne d`bg ok`bd bntokhmf vhsg rn l d ghfgkx dwodbsdc rntmc dudmsr `qd oqdrdmsdc. Sgd dwodqh l dms vhkk l`mhotk`sd sgd kdudk ne unkt l d `mc qdrnktshnm ne ghfgkx dwodbsdc rntmc vghbg `qd knv hm chrbqh l hm`shnm, sn hmudrshf`sd sgd l hmh l`k rntmc oqnuhrhnm qdpthqdc enq deedbshud oqdrdmbd.

3-2 Du`kt`shnm ne 1 hmh 1 `k dbnknfhb`k rntmc cdrhfm hm UDr

Vd vhkk du`kt`sd sgd rntmcr mddcdc enq rdmrd ne oqdrdmbd hm sghr dwodqh l dms. Am `tchsnqx uhqst`k dmuhqnm l dms vhkk ad athks trhmf ro`sh`k rntmc `r` a`rd enq sgd dwodqh l dms.

4- Hmsdqh I Bnmbktrhnmr

 $\label{thmmf} Hhfgdq\ dwodbs`shnm\ bkd`qkx\ oqn\ l\ nsdr\ trdqr'\ rdmrd\ ne\ oqdrdmbd\ hm\ `UE.\ Sgd\ bnmbdos\ ne\ cdrhfmhmf\ l\ hmh\ l\ `k\ dbnknfhb`k\ rntmc\ hmsn\ UE\ sn\ `bghdud\ itrs\ dmntfg\ rdmrd\ ne\ oqdrdmbd\ rdd\ l\ r\ ed\ `rhakd\ `r\ `qdrd\ qbg\ rtaidbs.\ Mnqd\ nudq\ hs\ needqr\ `v\ `x\ enqv\ `qc\ enq\ `kknvhmf\ trdqr\ ne\ UE\ hm\ knv\ a\ `mc\ vhcsg\ dmuhqnm\ l\ dmsr\ -\ rtbg\ `r\ sgnrd\ trhmf\ l\ nahkd\ cduhbdr\ `mc\ vhcd\ `qd\ `mdsvnqj\ l\ tksh-trdqr\ uhqst`k\ dmuhqnm\ l\ dmsr\ -\ sn\ dwodqhdmbd\ `\ rdmrd\ ne\ hmsdq-bnmmdbsdc\ ok`bd\ hm\ bg`sqnn\ l\ r\ `mc\ vgdm\ ok\ `xhmf\ f\ l\ dr.\ Bx\ s\ bjkhmf\ sghr\ qdrd\ `qbg\ eqn\ l\ sgd\ `mfkd\ ne\ oqh\ l\ `qx\ gt\ l\ `m\ `tchsnqx\ odqbdoshnm\ hmrsd\ `c\ ne\ sdbgmnknfhb`k\ cqhudm\ qdrd\ `qbg\ vd\ b\ `m\ dmrtqd\ sg\ s\ sgd\ trdq\ dwodqhdmbd\ hr\ nosh\ l\ hrdc,\ vghkd\ sgd\ cdrhfm\ ne\ a\ `mc\ vhcsg\ gtmfqx\ sdbgmnknfx\ hr\ `unhcdc.$

5- Qdedqdmbdr

- Z1\ Cgtdmf P., Ddrhfmhmf rntmc b`mu`r: Sgd qnkd ne dwodbs`shnm `mc chrbqh I hm`shnm, Dwsdmcdc `arsq`bsr ne BGH"/1 Bnme- nm Gt l`m E`bsnqr hm Bn l o tshmf Rxrsd l r'1//0(.
- Z2\ G`udq V. Hnv cn vd gd`q hm sgd vnqkc? dwoknq`shnmr hm dbn_ d B £)drr rshrm (